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ABSTRACT

This environmental education program emphasizes the cause and effect of change in a freshwater marsh ecosystem with special attention given to man and his role in environmental change. Concepts are employed from the natural and social sciences to investigate environmental problems. Unit activities are inquiry oriented and answer these questions: (1) What is an ecosystem?; (2) What is a description of the ecosystem being investigated?; (3) What are some of the biotic and abiotic features of the ecosystem and how do these features interrelate?; (4) Where are some specific locations of the ecosystem being investigated?; (5) What biotic and abiotic features in the ecosystem have changed and are undergoing change?; (6) What are the natural factors causing change in the ecosystem and how have they been brought about?; (7) What are the man-made factors causing change in the ecosystem and how have they been brought about?; (8) What are the results of the changes?; (9) What, if any, new changes are needed in the ecosystem?; and (10) How might these needed changes to the ecosystem be brought about? Questions 5-10 are designed into a role-playing simulation game. The guide also contains readings, maps, and other handouts, resources, evaluation techniques, and teacher suggestions for program implementation. Slides with descriptions are included. (Author/MR)

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Man's Impact on the Environment

The Freshwater Marsh as an Ecosystem

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MAN'S IMPACT ON THE ENVIRONMENT

An Environmental Learning Unit

Developed as a portion of the

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"BROAD SPECTRUM ENVIRONMENTAL EDUCATION PROGRAM"

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RATIONALE

Environmental degradation is recognized as a concern of increasing magnitude. Man is the precipitating factor in the deterioration of the human and non-human factors of his environment, his highly touted accomplishments notwithstanding. It is postulated that environmental problems are exacerbated by man's lack of knowledge and understanding of his surroundings, both physical and social, as well as individual motivation to act respectfully toward his environments.

This broad spectrum environmental education program has been developed to combat this shortage of understanding and feeling. Employing concepts from both the disciplines of natural and social sciences, a learner can be exposed not only to the physical phenomena that are being affected in his environment but also can be made aware of the human consequences of these changes. The application of the self-discovery techniques used in this learning activity package will result in a learner who:

1. Demonstrates a significantly increased level of knowledge and understanding of the interrelationship of both human and non-human aspects of his environment.
2. Demonstrates a significantly higher positive attitude toward his environment.

By accomplishing these objectives with a substantial number of students, they would be equipped with the basic tools with which to actively pursue solutions to environmental problems.

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FOREWORD

Man's Impact on the Environment is a learning activity package designed to foster an improvement in the learner's knowledge of and attitude toward his environment. As the title might suggest, this package views man as he affects his environment, both the living and non-living features. Consequently, the unit of analysis used for this study is the ecosystem, a system in which the many relationships among the living (biotic) and non-living (abiotic) aspects of any given environment are investigated.

The ecosystem view of the environment is brought into sharp focus by utilizing the conceptual theme of change. Biological, physiological, and sociological change are all facets of this particular conceptual approach. Major emphasis is given to the cause and effect of change in an ecosystem and special attention is given to man and his role in environmental change.

To facilitate the investigation of change in various ecosystems, an analytical model - a series of generalized but basic questions applicable to a number of similar units of analysis - about change in an ecosystem has been developed. In Man's Impact on the Environment, learning activities are provided that apply this analytical model to a series of specific ecosystems: barrier beach, estuary, freshwater marsh, the city. It is believed that once a learner becomes acquainted with this model, he can use it as a guide to study any ecosystem he wishes.

The application of this model to selected ecosystems is made through an inquiry, or self-discovery, learning approach. Even though the learning activities are based on a very directed inquiry technique, the learner still benefits from using his analytical skills, gaining facts, and exploring and clarifying his values and attitudes toward the environment.

How To Use This Learning Packet

This learning activities package is divided into three major sections -- Learning Activities, Student Comments (SC) and Teacher Comments (TC). The Learning Activities section provides investigations for each inquiry question listed in the analytical model. These investigations are designed to guide the learner toward a well grounded conclusion to the inquiry questions. Along with the Learning Activities, this division includes **Resources** needed to complete the investigations, suggested **Evaluation** procedures for student performance, and **Teacher Suggestions.** The evaluation techniques are explained in depth later in this **Foreward.** Student **Comments** are readings, maps, and other handouts that are integral parts of the Learning Activities and are to be reproduced for learner use. The Student Comments are numbered and located all together following the section on Learning Activities. Teacher Comments give background information on a variety of aspects of the ecosystem being studied. Even though the Teacher Comments are primarily designed for the teacher, many instructors have found it useful to reproduce these for their students to use.

In an effort to make this learning packet as student-oriented as possible, there has been included an explanation of a workable program in which students conduct class discussion. Read carefully the following Suggested Model for Student-Directed Class Discussion for possible implementation in your classroom.

Man's Impact on the Environment also provides a series of suggested methods for evaluating learner performance. Employment of these particular techniques are not critical to the success of the learning unit, but are procedures that have proved meaningful to the classroom teachers who developed this learning activity package. A Proposed Scheme of Techniques for Evaluating Student Performance merits close attention and can be found in this Foreward.

A Suggested Model for Student-Directed Class Discussion

"The only learning which significantly influences behavior is self-discovered, self-appropriated learning. Self-appropriation or 'learning it for myself' happens when there is process, or when the student is an activist . . . or when the student is searching, or when the student is doing anything with the teacher -- like understanding or loving him."*

One process that can be actively utilized for self-discovered learning is the student-directed class discussion. Discussion revolving around challenging, inquiry oriented questions supplied by the teacher, but conducted exclusively by the students, will provide the participants the opportunity for active involvement. Student-directed discussions allow the student to express opinions openly and argue freely for his point of view in an atmosphere monitored by his peers instead of the, more often than not, staid question and answer situation structured by the teacher.

Class discussions directed by students also free the teacher to become a sharper observer of student interaction, a better listener, and more effective evaluator. By allowing students the chance to conduct class discussions and refraining from voicing personal opinions and making authoritative statements, the teacher will have more time to observe, listen, and evaluate. Student confidence is developed when the teacher allows them to work out their own problems and acts as a guide and not the sole intellectual authority in the room. Teacher suggestions should be offered sparingly and only if students get too far off the subject and just can't get back to the business at hand.

One highly successful model for student-directed class discussion has been employed for several years in social studies classes at DeLaura Junior High School, Satellite Beach, Florida.

* Carl Rogers

Students assume the three following positions: (1) Moderator, (2) Board Recorder, (3) Desk Recorder. These positions are all voluntary and students may choose to be one, two, or all three, not all at once. A sheet of paper for each position may be passed around the room, and students may sign up for any, all, or none of these. When any position is needed, the teacher can just pick one student, starting at the top of the list. Moderator and Board Recorder serve one class period and the Desk Recorder serves throughout the entire discussion of the overall issue. These positions are excellent for those quiet, shy students who hesitate to express their opinions in a large group. A teacher should award extra points to those students who volunteer for these positions.

(1) The Moderator - Responsibilities

A. Calls on students who wish to express themselves.

B. Continues to call on students who wish to speak as long as there is quiet cooperation of the remaining students.

C. Maintains parliamentary procedure. (Simple parliamentary procedure might be explained by the teacher -- point of order, call for question, making a motion, etc.)

D. Does not express an opinion.

(2) The Board Recorder - Responsibilities

A. Records pertinent information on chalkboard as directed by students so that the Desk Recorder can make a copy of the information for the class log and help keep discussion on the point.

B. May express opinions when recognized by the Moderator.

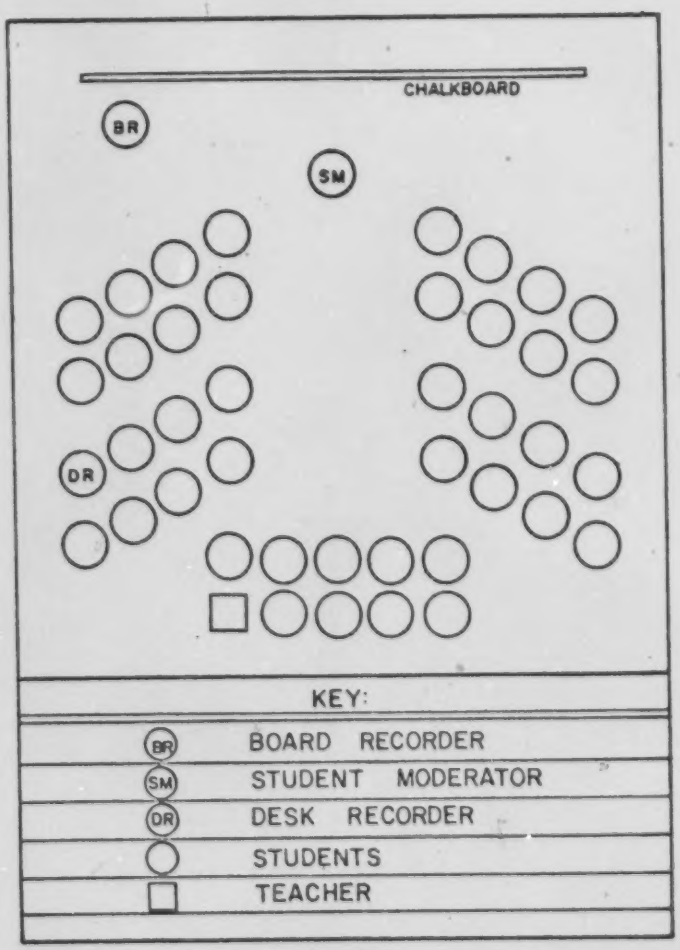
(3) The Desk Recorder - Responsibilities

A. Records in a class log information exactly as it appears on the chalkboard.

B. Acts as secretary when arguments occur over previous material by referring to previous records in log.

C. Places previous day's work on chalkboard at the beginning of each class meeting.

D. Records information on ditto at the conclusion of the discussions for distribution to members of the class.



Physical arrangements of the class environment contribute significantly to class discussion. Desks should be situated so that students can generally face each other for easier interaction and see the chalkboard without difficulty. See diagram at left.

Remember! The teacher is an observer, listener, and evaluator! One suggested scheme for evaluating large group discussion is explained in the next section on Evaluation Techniques. If this Student-Directed Class Discussion is to be adopted in your classroom, thorough explanation should be made to your students before starting the unit of study.

-David MacDonald, June Schmidlkofer
Social Studies teachers
DeLaura Junior High school
Satellite Beach, Florida

A Proposed Scheme of Techniques for Evaluating Student Performance

Evaluating student performance is difficult at best. Most classroom teachers have developed systems for "grading" their students with which they are most comfortable. Other teachers are quite uncomfortable with any techniques for measuring student progress. We make no attempts at solving the problems and inequities inherent in most evaluation schemes. We only present some ways that some classroom teachers have used and have found to be successful for them. Please review the suggested methods included here and modify for use in your own situation. Whatever general evaluation process is chosen, explain its function to your students before beginning the unit of study.

Student achievement can be evaluated on more than written tests, even though these have their place. Additional areas of measurement may include large group discussion, small group work, self-evaluation, oral reports, visual creations (posters, charts, graphs, diagrams, collages), and written assignments.

One suggested method of scoring these and other areas is through a point system in which a higher number of points reflects higher quality. A point scale is established for each area being judged, points are granted either by students or teacher for an individual's performance and each student records his own accumulation of points. This record could take the form of an Individual Point Sheet (I. P. S.) shown on the next page. The sheet serves as a summary for points given in the four categories of evaluation discussed in this section on Evaluation Techniques. Other aspects of evaluation, not included on the Individual Point Sheet may be included at the teacher's discretion. Be creative and reward your students for the good they do. Accentuate the positive and eliminate the negative.

Point Sheets are kept for one week at a time by the student who totals his points and then turns them in to the teacher. At the end of a standard grading period, all I. P. S. totals are added and the teacher converts them into a grade.

Each of the divisions on the I. P. S. are explained on the following pages and detailed scoring instruments are provided for your consideration in the Teacher Comment section.

INDIVIDUAL POINT SHEET

Name _____

Total Points _____

Period _____

Week _____

Large Group Discussion Points

M.

T.

W.

Th.

F.

Sub-total _____

Self-Evaluation Points

M.

T.

W.

Th.

F.

Sub-total _____

Small Group Work Points

M.

T.

W.

Th.

F.

Sub-total _____

Oral-Visual-Written Points

M.

T.

W.

Th.

F.

Sub-total _____

Large Group Discussion

Large group discussion is probably the most widely used learning technique in the classroom. Most of the time this type of discussion is teacher-centered or directed. However, it is possible for class discussions to be student directed; this leaves the teacher free to be an observer, listener, and evaluator. The section, A Suggested Model for Student-Directed Class Discussion, page ix, gives details in how to establish a student-directed discussion.

With students directing class discussion the teacher has the opportunity to become a more reliable evaluator. Most teachers have their own methods for judging their students' comments as a group discussion progresses, however for those instructors who may wish some help in this matter we have included a sample checklist in the Teacher Comment Section as a possible measuring device.

Large group discussions are used frequently throughout this unit of study, especially as a technique for summarizing or reaching a concluding answer to the Inquiry Question being investigated. Class discussion has been shown to be one of the students' favorite means for learning, therefore it is an excellent opportunity for the teacher to evaluate young people's thinking and expression. If the suggested checklist mentioned above is to be employed, explain its use to the students before the unit of study is begun.

Small Group Work

Small Group Work is an effective method used to develop communication, cooperation, self-expression, leadership, creativity, interaction and sharing of ideas and knowledge. This technique is successful with students in most learning situations.

The purpose of this technique is to develop a student-centered classroom rather than a teacher-directed classroom. Through these small group discussions, students feel freer to express themselves and some develop leadership skills which are not present in large groups. Other benefits are that students learn to work or cooperate with a variety of their peers and not just the same group all the time. Most students learn to cope with a new situation and/or problem to solve. It is imperative that a teacher strive to allow students to solve their own group problems. Teachers should allow students in small groups to elect their leadership except in No. 4 (Captain-selection) of the ideas below.

Here are some suggested ways to organize students into small groups.

1. Counting-off
   a. Decide the number of groups needed.
   b. Suggest four to six members in each group.
   c. Start count anywhere in the room with #1 and go to desired number (4-5-6).
   d. Continue counting off until all students are members of a group.

2. Drawing numbers
   a. Same as No. 1a above.
   b. Same as No. 1b above.
   c. Put in a box the desired sets of numbers.
   d. Students will draw from the box a numbered slip of paper which will determine their group.

3. Self-grouping

   a. Arrange furniture prior to class meeting for desired number of groups.

   b. Choice of location selected by student upon entering the room.

4. Captain-selection

   a. Count off and select desired number such as every tenth person from the rollbook. Student has choice of being or not being a captain.

   b. Continue this until the desired number of captains have been obtained.

   c. Position captains at various stations in the room, as selection is being made.

   d. Captain selects team members. Captain's position is rotated among team if desired.

   e. Continue until all members of the class are on a team.

- David McDonald, June Schmidlkafor
Social Studies Teachers
DeLaura Junior High School
Satellite Beach, Florida

Many teachers refuse to incorporate small group work in their classrooms because they lack a satisfactory procedure for evaluating the outcome of such efforts. For the purpose of this unit of study, we suggest the use of the following process for checking the results of groups investigating each Inquiry Question. Use only where it is practical to do so.

1. At the end of the study of each Inquiry Question, there will be an exercise in the Learning Activities column entitled Check I. Q. At this point have each individual within a small group write out what he thinks is the answer to the Inquiry Question, by filling out the upper half of the I. Q. (Inquiry Question) Check form provided in the Student Comment section.

2. Teacher collects I. Q. Check sheets and gives to a different small group for grading.

3. Class members will:
   a. Have in front of them a copy of class conclusion for the Inquiry Question arrived at during the Investigations.
   b. Decide how many total grade-points should be possible for the proper response to the Inquiry Question.

4. Each small group will compare the answer sheet handed it with class conclusion and then fill out the lower half of the I. Q. Check form. Experience has shown that more honest and serious evaluations are made when students do not know who is checking whose paper. The name of the checker on the I. Q. Check form is for the teacher only.

5. Return I. Q. Checks to teacher who may reveal scores to students.

If this method of evaluation is employed, it would be essential for students to remain in the same small group until completion is made of all investigations for any one Inquiry Question.

Self-Evaluation

Appraising one's own progress is probably the most effective means of evaluation. No one better than the student himself knows how interested he was in the subject, how clearly he understands the concepts, how much effort was expended on the learning activities, or how much cooperative participation he took in group ventures. A system of self-evaluation can guide a student to a place where he can see his own strong features as well as weak ones. From this vantage point, he can begin to make constructive changes in his behavior.

In the Student Comment Section there is provided one sample measuring device which could be utilized throughout this unit of study. If this instrument or some similar form is adopted, please explain its use to students before any learning activities start.

Oral - Visual - Written Assignments

Variety is a key to comprehensive evaluation of student progress. Oral reports, visual creations and written assignments are but a small list of activities that can be used to measure the growth of students. While formal oral presentations are at a minimum in these units of study, they may be required and we have included a sample form for evaluating such reports in the Teacher Comment Section. Visual work is called for more frequently throughout the learning activities, therefore we have suggested some guidelines for scoring this type of effort in the Teacher Comment Section. These two forms could be easily modified for any local situation. The range of written assignments requested is so great that the evaluation of this area is left completely up to the teacher. Whatever methods for evaluating oral, visual, and written assignments are applied should be carefully explained to students before beginning the unit of study.

ACKNOWLEDGEMENT

This Project would have been impossible without the efforts and cooperation of the classroom teachers who helped develop, test, and revise these environmental learning units. The assistance given by Dr. Edwin Shirkey, of Florida Technological University in Orlando, Florida, to evaluate the students' performance outcomes was invaluable. Students participating in all the Pilot Classes made many constructive suggestions for revising the learning units.

Special mention goes to those teachers who performed extra tasks. David MacDonald and June Schmidlkofer were instrumental in writing A Suggested Model for Student-Directed Class Discussion and parts of the section on evaluating student performance. Eric Johnson, Robert Findlay and JoAnn Stringer acted as the revision committee, making the changes that made this final product possible. Nina Belle Fritz, Ellen Claussen and Linda Lincoln spent hours drawing up a package of material that would explain to teachers how they could use Man's Impact on the Environment.

My greatest appreciation is extended to all of these individuals.

Roger L. Henry
Chairman

LOOKING AHEAD

Looking Ahead is a feature provided for those teachers who wish to be prepared for the learning activities by securing the needed resources not supplied within this package before it is time to use them.

Looking Ahead at the Barrier Beach

	Resource Needed	Place Use (Page Number)
1.	Filmstrip: Keys to Basic Ecology	3
2.	Field trip site	8
3.	Materials kit	8
4.	Film: One Day at Teton Marsh	11
	or World in a Marsh	11
5.	Maps: county and state	13
6.	Special Format for Inquiry Questions V – X	15
7.	Resource person	24
8.	Films: Alligator or Prowlers of the Everglades	24

A MODEL FOR INVESTIGATING CHANGE IN ECOSYSTEMS

An Inquiry Study

I. What is an ecosystem?

II. What is a description of the ecosystem being investigated?

III. What are some of the biotic and abiotic features of the ecosystem and how do these features interrelate?

IV. Where are some specific locations of the ecosystem being investigated?

V. What biotic and abiotic features in the ecosystem have changed and are undergoing change?

VI. What are the natural factors causing change in the ecosystem and how have they been brought about?

VII. What are the man-made factors causing change in the ecosystem and how have they been brought about?

VIII. What are the results of the changes?

A. Beneficial?
B. Detrimental?

IX. What, if any, new changes are needed in the ecosystem?

X. How might these needed changes to the ecosystem be brought about?

LEARNING ACTIVITIES

Inquiry Question:

I. What is an ecosystem?

Learning Activities	Resources	Evaluation	Teacher Suggestions
Investigation #1:			
A. INTRODUCE 1. Write this question on chalkboard: "What is an ecosystem?" 2. Tell class they are going to: a. Observe an ecosystem. b. Record all they see or sense in their observations. c. Predict a definition of ecosystem.	A. INTRODUCE	A. INTRODUCE	A. INTRODUCE 1. This Investigation will lead students to define ecosystem. 2. The school grounds will serve as an adequate ecosystem for observation.
B. OBSERVE 1. Divide class into small groups. 2. Take groups outside on school grounds and deploy at various sites. 3. Tell all groups to record all they see and sense in their surroundings.	B. OBSERVE	B. OBSERVE	B. OBSERVE
C. PREDICT/DISCUSS 1. Using their recorded observations, have each group develop a predicted definition of ecosystem. 2. Have each group report its definition to the class and through discussion, reach a consensus on the meaning of ecosystem.	C. PREDICT/ DISCUSS	C. PREDICT/ DISCUSS Collect written copies of definitions and check.	C. PREDICT/DISCUSS 1. At this time, do not make any comment on whether or not the definition is correct. 2. Record consensus on chalkboard.

Inquiry Question:

I. What is an ecosystem?

Learning Activities	Resources	Evaluation	Teacher Suggestions
D. VIEW 1. Tell the class they are going to: a. View a sound filmstrip b. Compare their definition of ecosystem with what they see and hear. c. Revise their class definition if necessary. 2. Show filmstrip on ecology.	D. VIEW 1. Keys to Basic Ecology "Interrelationship Set" Filmstrip #1 - Ecosystem. 2. Order from: Olin Educational Services, 460 Park Ave., New York, N.Y. 10022.	D. VIEW	D. VIEW 1. An alternate filmstrip that could be used: a. Our Environment: Problem or Promise, Filmstrip #211 - "Ecology: The Web of Nature." b. Order from: A.J. Nystrom and Co., 3333 Elston Ave., Chicago, Illinois 60618. 2. Any local visual-aid that shows the definition of an ecosystem can be used.
E. DISCUSS 1. Through class discussion, revise predicted class definition if needed. 2. Familiarize students with the meaning of biotic and abiotic, as they relate to the definition of ecosystem. These words will be used throughout the unit of study.	E. DISCUSS	E. DISCUSS	E. DISCUSS 1. One definition of ecosystem -- "a system in which the biotic (living) and abiotic (non-living) features are in constant interaction." 2. Meanings: Biotic means all things living or recently living. Abiotic means all things non-living. Bio- from the Greek, bios, meaning life. A- from the Greek, meaning not.

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Inquiry Question:

I. What is an ecosystem?

Learning Activities	Resources	Evaluation	Teacher Suggestions
			3. TC # 1 , p. 135, will help in a detailed discussion of what is considered living and not living.
F. OBSERVE 1. Divide class into small groups. 2. Tell students they are going to: a. Check their new definition with the ecosystem they first observed. b. List specific examples of: (1) biotic/abiotic features they observe (2) relationships among those features. 3. Take students back out to school grounds.	F. OBSERVE	F. OBSERVE Collect list of observations.	F. OBSERVE Remind students to carry a revised definition with them to the school grounds.
G. DIAGRAM Have each group work together using observation lists and produce one diagram which illustrates the various interdependent relationships among the biotic and abiotic.	G. DIAGRAM	G. DIAGRAM Collect diagrams and check.	G. DIAGRAM 1. Suggest that arrows (→) could be used to show relationships. 2. This could be an individual assignment and worked on at home.

Inquiry Question:

I. What is an ecosystem?

Learning Activities	Resources	Evaluation	Teacher Suggestions
H. CHECK I. Q. Have students check results of their small group work.	H. CHECK I. Q.	H. CHECK I. Q. SC #1, p. 37.	H. CHECK I. Q. TC #2, p. 136, gives procedure for this check.
I. EVALUATE SELF Have students evaluate themselves.	I. EVALUATE SELF	I. EVALUATE SELF SC #2, p. 38.	I. EVALUATE SELF If Individual Point Sheets (I. P. S.) are to be used, reproduce sample form on page xiii of the Foreword and distribute to students.

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Inquiry Question: II. What is a description of the ecosystem being investigated?

Learning Activities	Resources	Evaluation	Teacher Suggestions
Investigation #1			
A. VIEW SLIDES Show students the set of marsh slides.	A. VIEW SLIDES Slides 1-20, p. 163.	A. VIEW SLIDES	A. VIEW SLIDES Pose Inquiry Question to students and have them consider it as they watch the slides.
B. DISCUSS/LIST 1. Divide class into small groups. 2. Have each group discuss the slides and make a list of: a. physical characteristics of a marsh, and b. plants and animals found in the marsh. 3. One list (parts a and b) from each group will be submitted for evaluation.	B. DISCUSS/LIST	B. DISCUSS/LIST Collect list and evaluate.	B. DISCUSS/LIST Read TC #3, p. 137.
C. DEFINE/REPORT 1. Using their lists as guides, each group will compose a description of a marsh. 2. Each group's description is reported by being placed on the chalkboard.	C. DEFINE/REPORT	C. DEFINE/REPORT	C. DEFINE/REPORT
D. DISCUSS Have class discuss each description and arrive at a composite of the best suggestions.	D. DISCUSS	D. DISCUSS TC #4, p. 138, can be used as a guide for evaluating class discussions.	D. DISCUSS

Inquiry Question:

II. What is a description of the ecosystem being investigated?

Learning Activities	Resources	Evaluation	Teacher Suggestions
E. READ/COMPARE Have each student read SC #3 and compare it with the class's composite definition. Make changes if needed.	E. READ/COMPARE SC #3, p. 39.	E. READ/COMPARE	E. READ/COMPARE
F. CHECK I. Q. Have students check results of their small group work.	F. CHECK I. Q.	F. CHECK I. Q. SC #1, p. 37.	F. CHECK I. Q. TC #2, p. 136, gives procedure for this check.
G. EVALUATE SELF Have students evaluate themselves.	G. EVALUATE SELF	G. EVALUATE SELF SC #2, p. 38.	G. EVALUATE SELF If Individual Point Sheets (I. P. S.) are to be used, reproduce sample form on page xiii of the Foreword and distribute to students.

Inquiry Question:

III. What are some of the biotic and abiotic features of the ecosystem and how do these features interrelate?

Learning Activities	Resources	Evaluation	Teacher Suggestions
Investigation #1 (Plan a Field Trip) A. CONDUCT PRE-FIELD ACTIVITIES 1. Arrange site visitation. 2. Divide class into the following inspection teams: a. One general inspection team: 1) 4-5 members 2) Read SC #4 for duties. b. Specific inspection teams for remainder of class: 1) 4-5 members 2) Read SC #5 for duties and data requested. 3. Construct a materials kit for each team. a. Collect necessary equipment. 1) Specific inspection team (SC#6, Part I) 2) General inspection team (SC#6, Part II) b. Make a checklist for each kit. c. Locate a collection box for each team.	A. CONDUCT PRE-FIELD ACTIVITIES 1. SC #4, p. 40. 2. SC #5, p. 41. 3. SC #6, p. 46. 4. SC #'s 7-14, pp. 47-63. 5. SC #5, p. 41. 6. SC #15, p. 67.	A. CONDUCT PRE-FIELD ACTIVITIES	A. CONDUCT PRE-FIELD FIELD ACTIVITIES 1. Brevard County teachers should contact the following source and specify type of ecosystem (fresh water marsh) they wish to visit: Merritt Island National Wildlife Refuge P. O. Box 6504 Titusville, FL 32780 2. Investigation #1 is designed to acquaint students with the biotic (living) and abiotic (non-living) factors of an ecosystem. Interrelationships can be shown best after two ecosystems have been investigated. 3. The procedures laid out for the investigation will be applied to other ecosystems studied. 4. It is necessary that each student have a working knowledge of all techniques and equipment needed for collecting the data required

Inquiry Question:

III. What are some of the biotic and abiotic features of the ecosystem and how do these features interrelate?

Learning Activities	Resources	Evaluation	Teacher Suggestions
4. Conduct a "dry run" of each study to be performed. a. Review SC #'s 7, 8, 9, and 10 and conduct tests. b. Have students enter results on data sheets (SC #5). c. Study SC #15 for counting and collecting procedures.			in SC #5. Most of these procedures are explained in the Student Comment #'s 7-14 and need to be reviewed by the teacher. These analyses can either be explained through demonstration or as inquiry-oriented investigations run concurrently with the ecosystem study.
B. EXECUTE IN-FIELD ACTIVITIES 1. Have students observe general site for five minutes before staking out a specific site. 2. Have them note or sketch all that is observed. 3. Have specific inspection teams select and stake out site and conduct studies required in SC #5.	B. EXECUTE IN-FIELD ACTIVITIES SC #5, p. 41.	B. EXECUTE IN-FIELD ACTIVITIES	B. EXECUTE IN-FIELD ACTIVITIES 1. Stress to students to watch for variety and differences. 2. To increase enthusiasm, the general inspection team may make a movie of the field trip. A great number of creative ideas can be developed around this media. 3. Encourage teams to scatter out their sites in order to obtain a variety of areas seen. Impress the need for accurate reporting.

Inquiry Question: III. What are some of the biotic and abiotic features of the ecosystem and how do these features interrelate?			
Learning Activities	**Resources**	**Evaluation**	**Teacher Suggestions**
C. PERFORM POST-FIELD ACTIVITIES 1. Have teams review procedures from Activity A-4 and complete necessary lab work. 2. Record results on Data Sheet (SC #5) and make required written work. (SC #'s 8-14) 3. Have teams construct a vertical drawing of their inspection site. a. See SC#16 for directions. b. Compare drawing with other groups. 4. Hold a class discussion to determine a general answer to the Inquiry Question. a. Use Data Sheets and drawings as sources of information. b. Record conclusions on chalkboard.	C. PERFORM POST-FIELD ACTIVITIES 1. SC #5, p. 41. 2. SC #'s 8-14, pp. 48-63. 3. SC #16, p. 68.	C. PERFORM POST-FIELD ACTIVITIES 1. Data Sheets and other written work can be collected and evaluated. 2. Vertical drawings can be evaluated.	C. PERFORM POST-FIELD ACTIVITIES Review SC #'s 8-14, pp. 48-63, to see what lab work is required.
D. CHECK I. Q. Have students check results of their small group work.	D. CHECK I. Q.	D. CHECK I. Q. SC #1, p. 37.	D. CHECK I. Q. TC #2, p. 136, gives procedure for this check.
E. EVALUATE SELF Have students evaluate themselves.	E. EVALUATE SELF	E. EVALUATE SELF SC #2, p. 38.	E. EVALUATE SELF If Individual Point Sheets (I. P. S.) are to be used, reproduce sample form on page xiii of the Foreword and distribute to students.

Inquiry Question:

III. What are some of the biotic and abiotic features of the ecosystem and how do these features interrelate?

Learning Activities	Resources	Evaluation	Teacher Suggestions
Investigation #2 (Alternate) A. PREDICT 1. Have students use their marsh definition and predict what they think would be the biotic and abiotic features and their relationships in a marsh. 2. Complete a chart that has these three columns: Biotic | Abiotic | Relationship B. VIEW Show a film (or filmstrip) that describes the marsh and have students check their predictions against the film.	A. PREDICT B. VIEW 1. One suggested film, One Day at Teton Marsh," Parts 1 and 2, color, 46 minutes. Walt Disney Prod. 800 Senora Ave. Glendale, CA 2. A second suggested film: World in a Marsh, color, 22 minutes, rental. McGraw-Hill Book Company Text-Film Dept. 330 West 42 St. New York, NY 10036	A. PREDICT B. VIEW	A. PREDICT This investigation is to be used if the field trip in Investigation #1 can not be taken. B. VIEW 1. Brevard teachers will find this film in the county Film Library, catelogue numbers 12-225 and 12-226. 2. If a suitable film can not be found, use the slides of a marsh at the end of this unit of study.

Inquiry Question:

III. What are some of the biotic and abiotic features of the ecosystem and how do these features interrelate?

Learning Activities	Resources	Evaluation	Teacher Suggestions
C. REVISE Following the film, have students amend their prediction-charts.	C. REVISE	C. REVISE Collect charts and evaluate.	C. REVISE
D. CHECK I. Q. Have students check results of their small group work.	D. CHECK I. Q.	D. CHECK I. Q. SC #1, p. 37.	D. CHECK I. Q. TC #2, p. 136, gives procedure for this check.
E. EVALUATE SELF Have students evaluate themselves.	E. EVALUATE SELF	E. EVALUATE SELF SC #2, p. 38.	E. EVALUATE SELF If Individual Point Sheets (I. P. S.) are to be used, reproduce sample form on page xiii of the Foreword and distribute to students.

Inquiry Question:

IV. Where are some specific locations of the ecosystem being investigated?

Learning Activities	Resources	Evaluation	Teacher Suggestions
Investigation #1 A. STUDY/LOCATE 1. Divide class into small groups and have each student: a. Study an outline map of their local county. b. Locate marsh areas with which they are familiar on this map. c. Justify each selected area on basis of conclusions reached to Inquiry Questions II and III. 2. Have students record their findings on a master map for their group.	A. STUDY/LOCATE 1. SC #17, p.70. 2. County maps can be obtained from county planning departments or local libraries.	A. STUDY/LOCATE 1. Evaluate justification given by students. 2. Collect maps and check.	A. STUDY/LOCATE 1. Students and teachers not living in Brevard County, Florida, obviously will want to investigate their own county. 2. Master maps can be made by projecting desk-size map through an opaque projector onto a large sheet of blank paper taped to the wall and tracing the outline of the map.
B. SEARCH/LOCATE 1. Have each small group: a. Make a library search to determine marsh areas in their state and locate an outline map. b. Identify factors which define each area as a marsh. c. Identify features, if any, which make each marsh unique (i. e. how grasses might differ between marshes in various state locations).	B. SEARCH/ 1. SC #18, p. 71. 2. State outline maps can be made from atlases found in the library.	B. SEARCH/ 1. Evaluate students' identification of factors. 2. Collect and check maps.	B. SEARCH/LOCATE 1. Students and teachers not living in Florida obviously will want to investigate their own state. 2. FLORIDA TEACHERS: At the close of this activity, point out that students will be investigating for the balance of this unit of study the freshwater marsh found in the Everglades of South Florida. 3. NON-FLORIDA TEACHERS: Have students conduct Activity C., SEARCH/LOCATE.

Inquiry Question:

IV. Where are some specific locations of the ecosystem being investigated?

Learning Activities	Resources	Evaluation	Teacher Suggestions
2. Have students record their findings on a master map for their group.			4. Activities D. and E. should be conducted for evaluation purposes.
C. SEARCH/LOCATE 1. Have each small group: a. Make a library search to determine marsh areas in Florida and locate an outline map. b. Justify each selected area on basis of conclusions to Inquiry Questions II and III. 2. Have students record their findings on a master map for their group.	C. SEARCH/LOCATE SC #18, p. 71.	C. SEARCH/LOCATE 1. Evaluate justification given by students. 2. Collect maps and check.	C. SEARCH/LOCATE At the end of this activity, point out that the Everglades of South Florida will be the center of the investigation for the balance of this unit.
D. CHECK I. Q. Have students check results of their small group work.	D. CHECK I. Q.	D. CHECK I. Q. SC #1, p. 37.	D. CHECK I. Q. TC #2, p. 136, gives procedure for this check.
E. EVALUATE SELF Have students evaluate themselves.	E. EVALUATE SELF	E. EVALUATE SELF SC #2, p. 38.	E. EVALUATE SELF

INVESTIGATIONS FOR INQUIRY QUESTIONS V – X

A SPECIAL FORMAT

Investigations for Inquiry Questions V – X have been arranged in a special format. The purpose and organization of these learning activities are explained below and should be read thoroughly along with the referenced Teacher Comments.

For students to understand the ecological composition of a marsh and ecological effect certain changes might have on a marsh, it is necessary to delineate some marsh as an example for them to study. The freshwater marsh found in the Florida Everglades can furnish the student with several examples of past, present, and possible future ecological changes which impact this ecosystem. A great deal of public attention has been focused on the Everglades marsh as a result of the national park which is located in the area and recent attempts to build a jetport there. Because of this attention, the student may be exposed to various arguments concerning change in the natural environment of a marsh area in order to meet the various needs of a growing population.

The student will study the Everglades by participating in a series of learning activities which have been designed into a role-playing simulation entitled The Everglades Survival Game. Read carefully Teacher Comment No. 5, page 139, for a thorough explanation of this simulation. No one activity will answer all of the questions, however, completion of all the Investigations should provide the student with sufficient data on which he can base legitimate conclusions to these inquiries.

The majority of Investigations in The Everglades Survival Game will be carried out in Learning Centers. Teacher Comment No. 6, page 149, gives a rationale and description of Learning Centers. Six Learning Centers, one for each of the Investigations, need to be created for this simulation. All activities and resources required at each Center are provided in this package. The materials should be available for student use throughout the entire simulation, however, the teacher may wish to set a time limit for the activities performed at the respective Learning Centers.

Inquiry Question:

V – X

Learning Activities	Resources	Evaluation	Teacher Suggestions
Investigation #1 (Plant/Vegetation Learning Center)			
A. READ/OUTLINE 1. Divide 1/6 of class into this Center. 2. Have students read SC #19 and then: - roughly outline the three major regions of South Florida on SC #20. - write a brief description of the vegetation in each region.	A. READ/OUTLINE 1. SC #19, p. 73. 2. SC #20, p. 74.	A. READ/OUTLINE Collect maps/descriptions and award ESP (see TC #5, p. 139).	A. READ/OUTLINE 1. Results of each Investigation will be presented to class (see Investigation #7). 2. Presentations should be practiced before going before class.
B. COMPARE/NOTE Have students compare SC #21 with SC #22 and make written notes of the changes in the three vegetation regions.	B. COMPARE/NOTE 1. SC #21, p. 75. 2. SC #22, p. 76.	B. COMPARE/NOTE Collect notes and give ESP.	B. COMPARE/NOTE Students should notice these changes: - National Park was created. - Heavy agriculture - Canals built - Highways built - Population increase - Conservation areas created
C. READ/WRITE 1. Have students read SC #'s 23-28 (and review SC #19). 2. Have students discuss change in the vegetation regions and then make a written report on these ideas:	C. READ/WRITE SC #'s 23-28, pp. 77-92.	C. READ/WRITE Collect copy of report and assign ESP.	C. READ/WRITE Detailed wording for the written report guidelines are found in the Inquiry Questions V – X, p. xxii.

Inquiry Question: V – X

Learning Activities	Resources	Evaluation	Teacher Suggestions
- kinds of change - causes of change - results of change - needed changes D. REPORT/PRESENT 1. Have students use facts from Activities A, B, and C and then compose a make-believe conversation to be held by a pine tree, a cypress tree, and a red mangrove tree on the subject "Our Changing Territory." 2. Have the "conversation" detail all the students have learned about change in the vegetation regions. 3. The "conversation" will be presented to the class later.	D. REPORT/ PRESENT	D. REPORT/ PRESENT Final "conversation" should be awarded ESP.	D. REPORT/PRESENT 1. To involve all students in the final presentation, several "conversations could be planned by this group. 2. All concluding activities at the Learning Centers will be presented to the class during Investigation #7.

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Inquiry Question:
V – X

Learning Activities	Resources	Evaluation	Teacher Suggestions
Investigation #2 (Muck Farming Learning Center)			
A. GRAPH/WRITE 1. Divide 1/6 of students into this Center. 2. Have students study SC #29 and then prepare a line graph of average rainfall in the Everglades. 3. Study the graphs and write out an explanation to the following question: - Has the rainfall changed significantly to cause 'the dehydration death of the Everglades'?"	A. GRAPH/WRITE SC #29, p. 93.	A. GRAPH/WRITE Give ESP for graphs and written explanations.	A. GRAPH/WRITE A relatively level line would indicate no drastic change in rainfall since 1940. A decreasing slope in line would indicate a decrease in rainfall. The line actually fluctuates from high peaks to low. The trend seems to be stable. There is no real decrease in the overall slope even if a straight line was drawn to represent the average line. Have the students try it. Decreasing rainfall is not the answer.
B. READ/DISCUSS 1. Students read SC #'s 23-28. 2. Students discuss the reasons for the statement, "We are losing our Muck."	B. READ/DISCUSS See SC #'s 23-28, pp. 77-92.	B. READ/DISCUSS	B. READ/DISCUSS
C. REPORT 1. Have group decide on a written composite report to the above statement. 2. Chairman records reasons and submits for evaluation.	C. REPORT	C. REPORT Award ESP for report.	C. REPORT

Inquiry Question:

V – X

Learning Activities	Resources	Evaluation	Teacher Suggestions
D. CREATE/PRESENT 1. From the above report, have students create a TV presentation: "We are losing our Muck." 2. Make a written script for the TV presentation which includes roles for each group member and is submitted for evaluation. 3. TV presentation will be made to entire class later.	D. CREATE/ PRESENT	C. CREATE/ PRESENT Evaluate the written presentation and award ESP.	D. CREATE/PRESENT PRESENT 1. Suggest to students that their TV presentation may cover the following ideas: - What are muck farmers? - How do they affect the Everglades? - Were the effects beneficial and/or detrimental? How? 2. Encourage students to give their suggestions.

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Inquiry Question: V – X

Learning Activities	Resources	Evaluation	Teacher Suggestions
Investigation #3 (Water Learning Center) A. GRAPH 1. Divide 1/6 of class into this Center. 2. Have students review SC #30 and then make a line or bar graph depicting the water use data.	A. GRAPH SC #30, p. 94.	A. GRAPH Collect and give ESP.	A. GRAPH 1. Water shortages are becoming acute in South Florida. Some scientists estimate only 10 years until the area will face severe water shortage in the winter months. As the population increases so does the water demand. 2. As more water is used in South Florida, the water table drops. The primary source of replenishment has been rainfall, particularly in the Everglades. But as the Everglades dry up, the water table there drops also. This allows salt water from the ocean to seep into what was before fresh water limestone "aquifers." Wells that once produced fresh potable water, now produce undrinkable levels of salt water. 3. TC #7, p. 153, gives background to the water control problem.

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Inquiry Question: V – X

Learning Activities	Resources	Evaluation	Teacher Suggestions
B. READ Have students read SC #31 and answer the following question: - How do you explain the movement of salt water inland?	B. READ SC #31, p. 95.	B. READ	B. READ
C. WRITE Using the data from activities A and B above, have student make a written analysis of the following statement: - As more fresh water is drawn from the underground water supply in Southern Florida, the original source of replenishment, the Everglades marsh, cannot maintain levels high enough to prevent salt intrusion from creeping into the fresh water sources on the coast.	C. WRITE	C. WRITE Collect written work and award ESP.	C. WRITE
D. ANALYZE DATA 1. Have students study SC #'s 32, 33, 34, and 35 and construct a chart on water for the years 1963 and 1967 which includes the following data: a. total rainfall in Everglades for each year, b. water discharge into the Everglades for each year, and	D. ANALYZE DATA 1. SC #'s 32, 33, 34, and 35, pp. 98-101. 2. SC #36, p. 102.	D. ANALYZE DATA 1. Collect chart and evaluate contents. 2. Collect written report and evaluate with ESP.	D. ANALYZE DATA 1. These gates and gauges are located in the northern section of the Everglades. They are responsible for controlling and measuring the water released into the Everglades. Note that the flow of water is from north to south.

Inquiry Question:

V – X

Learning Activities	Resources	Evaluation	Teacher Suggestions
c. gauge (water) height — in lowest and highest readings — in the Everglades for each year. The charts may look like SC #36. 2. Having completed their chart, students will analyze the data by noting answers to the following inquiries: - How does rainfall compare for the two years? - How does water discharge compare for the two years? - How does gauge (water) height compare for the two years? - Is rainfall responsible? - What is responsible for the differences? 3. In a written summary report, have students answer these questions: - How does water discharge by the FCD affect water levels in the Everglades? Is this good or bad? - If the FCD continues the policy of water discharge as explemplified in 1963, what do you predict will be the effect on the Everglades environment?			2. TC #8, p. 157, shows data that students should have selected from SC #'s 32, 33, 34, and 35. 3. Students who wish to conduct an indepth study of the water control measures may get in touch with the following: Central and Southern Fla. Flood Control District P. O. Box V West Palm Beach Florida 33402

Inquiry Question:

V – X

Learning Activities	Resources	Evaluation	Teacher Suggestions
E. READ/LIST 1. Have students read SC #'s 23-28. 2. Have students decide how each of the following would react to the readings: - a biologist - a conservationist - a FCD member - an engineer 3. List reactions for each viewpoint represented.	E. READ/LIST SC #'s 23-25, pp. 77-92.	E. READ/LIST	E. READ/LIST
F. PLAN/PRESENT 1. Have students plan a panel discussion, in which the four viewpoints (Activity E) are argued. 2. The Panel Discussion will be presented to the entire class later.	F. PLAN/PRESENT	F. PLAN/PRESENT Evaluate with ESP.	F. PLAN/PRESENT

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Inquiry Question:

V – X

Learning Activities	Resources	Evaluation	Teacher Suggestions
Investigation #4 (Wildlife Learning Center)			
A. DISCUSS 1. Divide 1/6 of class into this Center. 2. Have students discuss the following questions: - What is an endangered species? - What is the value of having an endangered species list?	A. DISCUSS President of Indian River Audubon Society: Harold E. Wyle, telephone 632-5855. Mr. Wyle may be able to help answer these questions.	A. DISCUSS Award ESP to students who offer valid answers and reasons.	A. DISCUSS Any member of local environmental groups could help with these questions.
B. VIEW/DISCUSS 1. Present to students either of these two movies: a. Prowlers of the Everglades b. Alligator 2. Have group discuss the following: a. What role does the alligator play in preserving the Everglades? b. What value to the Glades is there in preserving large areas in which the alligator can roam in a wild state? 3. If films are unavailable, SC #'s 37 and 38 should be read for background information on the alligagor.	B. VIEW/DISCUSS 1. Prowlers of the Everglades may be purchased from: Walt Disney Educational Materials 800 Senora Ave. Glendale, CA 91207 2. Alligator may be borrowed, free of charge, from: Central and Southern Flood Control District P. O. Box 1671 West Palm Beach Florida 33402 3. SC #37 and 38, pp. 103-104.	B. VIEW/DISCUSS Award ESP on basis of individual performance in the group's effort to answer the questions.	B. VIEW/DISCUSS Brevard teachers may borrow Prowlers of the Everglades from the County Film Library (#12-100).

Inquiry Question:

V – X

Learning Activities	Resources	Evaluation	Teacher Suggestions
C. REVIEW/LIST/DISCUSS 1. Review SC #39, a list of endangered species of the United States. 2. Review SC #40, a list of animals of the Everglades. 3. List, by comparing the two, all species of the Everglades that are rare and endangered or nearly so. 4. Discuss the advantages and disadvantages of preserving the Everglades for the benefit of these species.	C. REVIEW/LIST/DISCUSS SC #'s 39, 40, pp. 109-110.	C. REVIEW/LIST/DISCUSS Award ESP for each species correctly identified and listed.	C. REVIEW/LIST/DISCUSS Further work may be initiated by students interested in pursuing the habits of some of these species.
D. READ/REACT 1. Have students read SC #'s 23-28. 2. Have students react to the changes in the readings as if they were one of the following: - a bald eagle - a Florida panther - a green turtle 3. Write out reactions.	D. READ/REACT SC #'s 23-29, pp. 77-92.	D. READ/REACT Collect written reactions and evaluate with ESP.	D. READ/REACT Inquiry Questions V – X provide details on the aspects of change to which students are to react.

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Inquiry Question:

V – X

Learning Activities	Resources	Evaluation	Teacher Suggestions
E. PLAN/PRESENT 1. Plan a skit in which written reactions from Activity D are demonstrated. 2. Skit should include the eagle, panther, and turtle presenting their views on change to the class.	E. PLAN/PRESENT	E. PLAN/PRESENT Judge skits by awarding ESP for content and presentation.	E. PLAN/PRESENT

Inquiry Question:
V – X

Learning Activities	Resources	Evaluation	Teacher Suggestions
Investigation #5 (Jetport Learning Center)			
A. READ 1. Divide 1/6 of class into this Center. If additional students are available they should be added to this group. 2. Have students read SC #41 (explanation for the "Jetport Controversy" simulation). 3. Have students select which roles they will play. Some students may have to play multiple roles.	A. READ SC #41, p. 112.	A. READ	A. READ 1. Prepare a copy of SC #41 and distribute to each student. 2. TC #9, p. 158, provides background for this controversy. This TC could be reproduced for student use also.
B. STUDY/LIST 1. Have the students read and study SC #'s 42, 43, 44, and 45 as they prepare for performing their roles. 2. List aspects of change (Inquiry Questions V – X) that occur in proposed Jetport area.	B. STUDY/LIST SC #'s 42-45, pp. 116-120.	B. STUDY/LIST Award all students who complete the reading and listing assignment with ESP.	B. STUDY/LIST
C. PLAN/PRESENT 1. After reading is completed, use list to plan details for the simulated public hearing on the Jetport. 2. Present to class later during Investigation #7.	C. PLAN/PRESENT	C. PLAN/PRESENT 1. Award role-playing students ESP based on the effectiveness of their acting. 2. Award ESP to all students who discuss and debate issue.	C. PLAN/PRESENT 1. Remind students that as role-players they are all residents of South Florida and will be directly affected by the outcome of the "hearing." 2. If you do not have a class secretary, appoint one to record number of valid contributions from individual

Inquiry Question:

V - X

Learning Activities	Resources	Evaluation	Teacher Suggestions
		3. If the Review Team votes to continue to build the Jetport, all students lose 50 ESP. If the Review Team votes not to build the Jetport, all students gain 50 ESP.	class members so that you may reward them for contributions. You might consider 5 ESP per contribution as an incentive for students to get involved in this activity. 3. DO NOT tell the students that they will either gain or lose ESP as the result of the Review Team's decision. This will serve as a surprise and as an illustration of how one gains or loses sometimes as the result of decisions of others. 4. The teacher might consider playing the role of either a supporter of the Jetport or of an opponent during the debate; however, if this is done the teacher must be sure that all students understand that the teacher is playing a role and that the things he says do not necessarily reflect either fact or even his own personal opinion.

Inquiry Question: V – X			
Learning Activities	**Resources**	**Evaluation**	**Teacher Suggestions**
D. READ/DISCUSS 1. Following the presentation of the "public hearing" have the entire class read SC #46. 2. Conduct a general class discussion in which students react to the article as it relates to the "public hearing."	D. READ/DISCUSS SC #46, p. 123.	D. READ/DISCUSS 1. Award ESP to students for valid contributions in class discussion of the article. 2. Have students write an essay in which they compare the Jetport case with the building of a housing project in a freshwater marsh. Ask, "Would the pro and anti arguments about the housing project be similar or different than those about the Jetport?" How similar? Award ESP for essays.	D. READ/DISCUSS

Inquiry Question: V – X

Learning Activities	Resources	Evaluation	Teacher Suggestions
Investigation #6 (Action Learning Center)			Investigation #6 is divided into three sets of activities. You may have the students at this Center work through all three sets or only one of the sets.
Activity Set #1			
A. READ 1. Divide 1/6 of class into this Center. 2. Have students read SC #'s 23-28.	A. READ SC #'s 23-28, pp. 77-92.	A. READ	A. READ
B. CREATE To demonstrate their opinions, outlook and feelings on the change in the readings, have the students write out one of the following: - a newspaper editorial written by an alligator - a dialogue between an alligator and the manufacturer of alligator handbags - a page from the diary of an Everglade Kite.	B. CREATE	B. CREATE Collect and evaluate written assignments with ESP.	B. CREATE Change aspects are detailed in Inquiry Questions V – X, p. xxii.
C. PLAN/PRESENT 1. Plan a way for these written materials to be acted out in skit form. 2. Present to class later.	C. PLAN/PRESENT	C. PLAN/PRESENT Judge skits on content and originality and give ESP.	C. PLAN/PRESENT

Inquiry Question:

V – X

Learning Activities	Resources	Evaluation	Teacher Suggestions
Activity Set #2 A. EXAMINE/DRAW 1. Have students study SC #'s 47, 48, and 49. 2. After examination of maps, have students draw in the following sections on SC #50. - major canals - major highways - water conservation areas - agricultural zones - national parks B. DESIGN 1. Have students design a mock "Peace Talks" session in which they discuss this topic: - Needed changes in the present use of the Everglades. 2. Have students represent the viewpoints of the following: - the National Park - a water conservation area - an agricultural zone - the Department of Transportation - Corps of Engineers	A. EXAMINE/DRAW 1. SC #'s 47, 48, and 49, pp. 127-129. 2. SC #50, p. 130. B. DESIGN	A. EXAMINE/DRAW Award ESP for accurate location on outline map. B. DESIGN Participation and discussion at Peace Talks merits ESP.	A. EXAMINE/DRAW B. DESIGN

Inquiry Question:

V – X

Learning Activities	Resources	Evaluation	Teacher Suggestions
C. ILLUSTRATE/PRESENT 1. Have students illustrate on chalkboard or on poster board the results of the Peace Talks. 2. Present the illustration to the class later.	C. ILLUSTRATE/ PRESENT	C. ILLUSTRATE/ PRESENT 1. Allow ESP for the listed changes. 2. TC #10, p. 161, may help in evaluation.	C. ILLUSTRATE/PRESENT
Activity Set #3 A. READ/DISCUSS/WRITE 1. Have students read SC #51. 2. Locate the Gold Coast on SC #49 and then have students discuss the meaning of this statement: - "As the Everglades goes, so goes the urbanized Gold Coast of Southeast Florida." 3. Write out a summary report of the discussion.	A. READ/DISCUSS/ WRITE 1. SC #51, p. 131. 2. SC #49, p. 129.	A. READ/DISCUSS/ WRITE	A. READ/DISCUSS/WRITE Encourage students to discuss the stresses on the urban portion of the ecosystem.
B. DRAW Have students assume they are a common housefly and then draw a series of cartoons depicting the urban problems he sees in the Gold Coast.	B. DRAW	B. DRAW 1. Award ESP for good cartoons. 2. TC #10, p. 161.	B. DRAW Possible problems: water shortages, power shortages, water/air pollution, others.

Inquiry Question: V – X

Learning Activities	Resources	Evaluation	Teacher Suggestions
C. DESCRIBE 1. Next, have "student flies" visit the highway system of Southeast Florida (see SC #49). 2. Describe in written form the different highways as to quality, quantity, usefulness and accommodation.	C. DESCRIBE SC #49, p. 129.	C. DESCRIBE Collect description and evaluate with ESP.	C. DESCRIBE
D. COMPARE 1. Have students write out a comparison of the following: - Which trip – across Southeast Florida highway system or through the Gold Coast – would be easier, more pleasant, more enlightening, more depressing.	D. COMPARE	D. COMPARE Collect comparison and evaluate with ESP.	D. COMPARE
E. PLAN/PRESENT 1. Have students plan a presentation of their cartoons, descriptions and comparisons. 2. Present to class later.	E. PLAN/PRESENT	E. PLAN/PRESENT Award ESP for presentations well done.	E. PLAN/PRESENT

Inquiry Question:

V – X

Learning Activities	Resources	Evaluation	Teacher Suggestions
Investigation #7 (General Class Session) A. PRESENT 1. Have each Learning Center group present the results of their investigation. 2. These presentations are made to the entire class. B. DISCUSS/LIST Following the presentations, have each group discuss and list answers to each of the following questions: a. What are some of the biotic and abiotic features of the ecosystem? b. What are some of the factors which have contributed to environmental change in the Everglades? c. How was the environment changed by man/nature? d. What were the results of the changes to the environment? (1) beneficial (2) detrimental e. If new changes are needed in the environment, what are they?	A. PRESENT B. DISCUSS/LIST 1. All notes and materials used throughout the Everglades Survival Game. 2. Data presented by each Learning Center should be helpful.	A. PRESENT B. DISCUSS/LIST Award ESP for participation in group's work.	A. PRESENT B. DISCUSS/LIST 1. Inform students that they may use all information they have accumulated since the beginning of the study of the Everglades to help them in answering the questions. 2. Have each group select a leader and a recorder to take notes each day they meet.

Inquiry Question: V – X

Learning Activities	Resources	Evaluation	Teacher Suggestions
f. How might these changes to the environment be brought about?			
C. REPORT/DISCUSS 1. Each group's leader or recorder will report to the entire class the answers they agreed upon for each of the questions. 2. Have class discuss and agree upon best answers for questions.	C. REPORT/DISCUSS	C. REPORT/DISCUSS 1. Award ESP for person reporting. 2. TC #11, p. 162.	C. REPORT/DISCUSS Encourage class to compare and contrast answers from each group.
D. CHECK I. Q. Have students check results of their small group work.	D. CHECK I. Q.	D. CHECK I. Q. SC #1, p. 37.	D. CHECK I. Q. TC #2, p. 136, gives procedure for this check.
E. EVALUATE SELF Have students evaluate themselves.	E. EVALUATE SELF	E. EVALUATE SELF SC #2, p. 38.	E. EVALUATE SELF

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STUDENT COMMENTS

STUDENT COMMENT NO. 1 : Small Group Evaluation

I. Q. (INQUIRY QUESTION) CHECK

Name _____ Group Number _____ Class Period _____ Date _____

Inquiry Question
Being Investigated: _____

My Answer to
this Inquiry Question: _____

_____

Important parts of this
Inquiry Question Answer
Left Out: _____

Points Possible for
this Inquiry Question _____

Points Awarded for
this Inquiry Question _____

Name of Checker _____

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STUDENT COMMENT NO. 2 : Self-Evaluation

SELF-EVALUATION FORM

Name_____ Period_____ Date_____

Directions: When you have completed all work on an Inquiry Question, use the Point Scale below and rate yourself on each of the categories listed in the chart.

Point Scale: 5 points – excellent; 4 points – above average; 3 points – average; 2 points – below average; 1 point – poor

CATEGORIES	INQUIRY QUESTION NUMBERS									
	I	II	III	IV	V	VI	VII	VIII	IX	X
Interest (To what degree were you interested in this Inquiry Question?)										
Understanding (To what degree do you feel you understand the conclusion to the Inquiry Question?)										
Effort (To what degree did you do all activities to the best of your ability?)										
Cooperative Participation (To what degree did you contribute useful ideas in solving group problems and/or help others reach a conclusion about this Inquiry Question?)										
Total Points										

STUDENT COMMENT NO. 3: Definition of a Marsh

A marsh is a shallow body of slow moving or still water whose surface is extensively broken with water adapted vegetation. The shallow depths of a marsh generally teem with plankton and are abundant with aquatic life. Attracted by the rich food source and the protection of tall grasses and other water tolerant plants, aquatic birds are plentiful. Predatory mammals are also present.

STUDENT COMMENT NO. 4: Duties for the General Inspection Team

The general inspection team will be responsible for the following:

(1) Seining for aquatic species
(2) Probing inspections for isolated species
(3) Photographing species too large to be collected
(4) Transporting common equipment

STUDENT COMMENT NO. 5: Duties for the Specific Inspection Team

The specific inspection team's responsibilities include: counting, recording, and collecting botanical and zoological organisms as well as conducting abiotic tests. Two students should be assigned to botanical features, one student to the zoological, and two students to the abiotic conditions. Specific information requested for these biotic characteristics is detailed on the following data sheets:

DATA SHEET FOR SPECIFIC INSPECTIONS

Team #_____ Date_____ Time_____

Name and description of collection site_____

_____

BIOTIC FACTORS

Botanical Population Studies

Macroscopic Organisms:

	Species Name	Number at Site	Average Height Above Ground
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

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Microscopic Organisms:

	Species Name	Number (amount) at Site
1.		
2.		
3.		
4.		
5.		

Zoological Population Studies

Macroscopic Organisms:

	Species Name	Number at Site
1.		
2.		
3.		
4.		
5.		
6.		

Microscopic Organisms:

	Species Name	Number at Site
1.		
2.		
3.		
4.		
5.		

Note any indications of animal life

a. Tracks

b. Droppings

ABIOTIC STUDIES

Soil Test

1. Core samples (one in each corner of site and one in the middle)

   a. Depth of cores _____

   b. Color and depth of color change in core
      (1) _____
      (2) _____
      (3) _____

2. Nutrient analysis (package each core for return to lab for inspection)

   a. Nitrogen content _____

   b. Phosphorus content _____

   c. pH _____

   d. Potassium hydroxide (KOH) _____

3. Moisture content of soil _____

4. Water holding capacity of soil _____

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Water Test -

1. Depth of sample _____

2. DO and BOD samples _____

3. Collect gallon water samples (s) for lab work
   a. Nitrate level _____
   b. Phosphorus level _____
   c. Salinity _____
   d. pH _____

4. Turbidity of water _____

General Studies

1. Air temperature in ℃ _____

2. Water temperature in ℃ _____

3. Weather conditions
   a. type of sky _____
   b. amount of humidity _____
   c. wind speed and direction _____

4. Sunlight
   a. at ground level _____
   b. 0.5 meters above _____
   c. 1.0 meters above _____
   d. 1.5 meters above _____
   e. 2.0 meters above _____

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5. Temperature

a. at ground level	_____
b. 0.5 meters above	_____
c. 1.0 meters above	_____
d. 1.5 meters above	_____
e. 2.0 meters above	_____

Comments:

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STUDENT COMMENT NO. 6: Equipment Needed for Field and Lab Work

Part I - Team Kits

2 centigrade thermometers
2 meter sticks
4 stakes
2 D. O. bottles
1 gallon jug
2 petri dishes
30 tags for marking plants
15 to 20 assorted bottles of formaldehyde
2 data sheets per team
4 or 5 scrap newspapers
1 collecting box

Part II - Common Kit (for use of all)

1 soil cover
1 triangular scoop
1 humidity indicator
1 Secchi disk
1 seine
2 light meters
1 wind indicator
1 camera (probably under the jurisdiction of one student)

Part III - Lab Equipment

1 or more Nitrate, Nitrite kits
1 or more Dissolved Oxygen kits
1 or more salinity test setups (as per investigation)
2 or more plant presses
3 or more dissecting scopes
forceps
1 incubator
1 or more Orthophosphate kit
2 dessicating ovens
3 to 5 new pH paper testers
2 or more Sudbury soil test kits
3 or more microscopes
assorted lab tools
scalpels
a classroom set of texts which includes guides or keys for identifying organisms

Note: Pay special attention to other items that might be needed to facilitate the field trip.

STUDENT COMMENT NO. 7: Describing A Community (Quadrat Construction)

MATERIALS: 1 meter stick; 4, 12" wooden stakes; 25 meters of a heavy cord such as chalkline; hammer; 4 thumbtacks.

In making population samples, one of the more effective methods involves employing quadrats. A quadrat may be defined as an area, or site, whose adjacent sides are at right angles to each other (these sides may be of any workable dimension). A convenient size for a quadrat is 1 m^2.

In laying out the quadrat, a random base point, A, is established and a stake is driven into the ground at that point. Points B, C, and D are then located by the obvious method of laying out a square whose sides are each 1 m in length. Having established all four points by means of wooden stakes, a cord is run between adjacent stakes and secured to the stakes by thumbtacks. Strings AB & CD are marked off in 10 cm sections; a cord is tied at the first mark on AB and the other end tied to the corresponding point on CD; this procedure is repeated on each of the marks until ten cords are attached to cords AB & CD. Cords AD & BC are marked in a similar manner and similar cords attached. If this procedure is followed, a quadrat of 100 cm^2 squares, will result.

The horizontal rows are labeled alphabetically, while the vertical rows are numbered; thus a given square may be identified by row and number, such as C- 4, designating the square 3 rows up from the bottom and four rows in from the left.

Teachers Curriculum Guide for Field Ecology, Center for Environmental Learning, Brevard County School Board, 1971.

STUDENT COMMENT NO. 8: A Study of Flora and Fauna of a Community

BACKGROUND: The character of any community is primarily determined by the plant life present. Since plants are the dominant features they are more often than not used to determine the name of the community. More subtle is the effect these dominant plants play in determining the types of animals present. Since they serve as a food source, only those animals that feed on them are likely to be present. In this study the students are given methods to describe the plant community. With a knowledge of the plant life present, perhaps a better understanding of the animals will be gained.

PROCEDURE: It is not imperative to know all the plant species but it would enhance the value of the study if the major plants are known. Those of seemingly lesser importance can be given common names agreeable by all. For that matter, all the plants can be given common names. However, the students should be familiar with them so that they can all give the same plant the same name.

At the selected site students should make a square meter with the meter sticks (see SC#7). The plant counters should count all the plants of each species within the square and record the information. The animal recorder's sole responsibility is to observe the plot for all animals present or signs of animals (tracks, feces, holes, etc.) and record the data (numbers aren't necessary for animals unless desired).

RESULTS:

1. Relative density - a calculation of the percentage of the total plant count a certain species is. From the list count the students should:

   a. Count the total number of all species.

   b. Count the total of each species.

With these data use the following formula to calculate the relative density of each species:

$$RD = \frac{\text{total number of species X}}{\text{total number of all species}} \times 100$$

2. Frequency - density of a species in a given site. If the number is low, the species may be one that occurs in patches. If the number is high, the species may be one that is prevalent in the study area. Use the data from all the different sites according to the following formula:

$$\text{Frequency} = \frac{\text{no. of sites in which species X occurs}}{\text{Total no. of sites}} \times 100$$

The students should calculate the frequency of each species, placing the results in a chart beginning with the highest and ending with the lowest frequency.

3. Graph the species area curve, which is an analysis of the sample size. It indicates whether or not the sample size was large enough to adequately describe the general site under study. The following steps should be followed:

a. Using a piece of graph paper, prepare on the horizontal axis the number of sites in the sample. On the vertical axis, prepare a scale that includes the total number of species in the study. At site #1, the total number of different species encountered should be graphed. At site #2, a count should be made of the number of new species encountered, i. e. - the number of species that are different from site #1. The procedure is repeated for site #3. All the new species encountered in site #3 that are different from site #1 and site #2 are graphed. Repeat the procedure until all sites have been graphed. Repeat the procedure until all sites have been graphed. Interpretation is based on the type of curve obtained. If the sample size is large enough and therefore valid, the curve should level off. If the sample size is not large enough, new species will still be encountered, therefore causing a continued slope in the line.

4. Analysis of the animal data. The list of animals observed directly or indirectly, should be listed on the board. From this list, the student should attempt to diagram the probable food web for the community. Reference texts should be made available so that the source of food for the animals can be determined by the student.

DISCUSSION:

1. From your relative density calculate which of the plants seem to be the most frequent.
2. What are some of the rarer plants of the community?
3. Based on your data, what do you think this type of community should be named?
4. Which species seems to be found everywhere in the community? What was the frequency?
5. Which species seems to be found in only one spot of a few places? What was the frequency?
6. According to your species area curve, was your sample large enough? How do you know?
7. From your animal data, which animals seem most prevalent?

CONCLUSION: Make a general statement based on your results on each of the following:

A. The name you gave to the community.
B. The frequency of plants in the community.
C. The relative density of plants in the community.
D. The sample size of your study.
E. The animals of the community.

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REFERENCES:

Kormondy, Edward J., Concepts of Ecology, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1969.

Smith, Robert Leo, Ecology and Field Biology, Harper and Row, New York and London, 1966.

STUDENT COMMENT NO. 9: Soil Nutrient Determination

Locate and use directions from Sudbury Soil test. An alternate method is to use test for pH found in High School Biology, BSCS Green Version, Second Edition, page 239 and then modify the same test for determining Potassium hydroxide, Nitrogen, and Phosphorous.

STUDENT COMMENT NO. 10: Moisture Content of Soil

BACKGROUND: Water content is defined as the amount of water in the soil at a particular time. It is important to know the amount of water in a soil that is available to the plant. In order to find out what is available we can measure the moisture content.

PURPOSE: To measure moisture content in the soil.

MATERIALS:

100 gram soil sample
Filter paper
Aluminum soda can

PROCEDURE:

1. Weight a dry, empty aluminum can. Record weight _____.
2. Collect soil sample and weight in the aluminum can. Record the weight _____.
3. Dry soil by using a Bunsen burner. Heat the soil for several minutes over an hour's time. Do this for two days. Cover the can overnight so that no moisture will get into it. (If drying oven is available, place soil in oven for 24 hours.) Record weight _____.
4. Weight the soil after 48 hours. Record weight _____. The weight loss will be the water loss.
5. Subtract the weight of the 48 hour sample from the original sample. (#2 - #4) (Example 60 g of soil before drying; after 48 hours, the soil weighed 50 g, then the total weight of water sample is 60-50, or 10 g.
6. Calculate the percent moisture by using the formula:

$$\% \text{ moisture} = \frac{\text{Loss of weight due to drying}}{\text{Weight of dried soil}} \times 100$$

Teachers Curriculum Guide for Field Ecology

STUDENT COMMENT NO. 11: Water-holding Capacity of Soil

PURPOSE: To measure water-holding capacity of the soil.

MATERIALS:

Dried soil from the moisture content experiment
Aluminum can
Graduated cylinder
(100 grams of dried soil if other soil is not available)

PROCEDURE:

1. Put a small hole in the bottom of the aluminum can. Now place 100 g of soil in the aluminum can.
2. Place can in a pan or beaker of water overnight to maintain moisture.
3. The next day raise aluminum can out of water and place a piece of filter paper on the bottom. Allow to drain 30 minutes.
4. Wipe the surface dry and weigh the unit.
5. Moisture-holding capacity is calculated as follows:

$$\text{Per cent moisture-holding capacity} = \frac{\text{Gain in weight after immersion in water}}{\text{Weight of dried soil prior to immersion in water}} \times 100$$

NOTE: The gain is computed by subtracting the combined weight of the can and dry soil from that of the can and wet soil.

OPTIONAL: Acidity and alkalinity can be tested by placing a drop of distilled water on a sample of dried soil. Use litmus paper to check acid or alkaline conditions of soils.

STUDENT COMMENT NO. 12: Biochemical Oxygen Demand

BACKGROUND: A high Biochemical Oxygen Demand (BOD) indicates that a great amount of oxygen is needed for bacteria and mold for the decomposition of a large amount of dissolved organic material. If the BOD is very high, the available amount of dissolved oxygen is utilized for decomposition and there is little left for larger animal and plant life. A BOD test can be affected by temperature, agitation, etc., but it gives a good estimate of the amount of decomposing activity that a body of water must support.

To perform the test collect samples in glass pint jars obtained from home or in 250 ml glass-stoppered bottles from the laboratory. However, all containers should be clean and similar in size. Locate collection points on a stream or lake. At each point rinse a collecting bottle several times in the water to be sampled. Then fill the jar to overflowing, cap it or stop it under water so that when the bottle is tipped, no free air bubbles can be seen.

Another procedure that may be necessary is to filter those samples which have visible algae or crustacean life within. Since BOD is essentially a measure of microscopic bacterial decomposition process, larger organisms in some samples may affect testing conditions and results. Thus, filter the sample through paper toweling or cloth as it is collected to remove the visible organism.

At the same time samples are collected, you should test for dissolved oxygen at the same sample site and record the results. Use the Hach DO test kit listed below.

The closed bottles should be identified according to test site designation and allowed to sit undisturbed in the dark at constant temperature for five consecutive days.

During this period, bacteria in the water will use up oxygen in the process of decomposing organic material in the water. The amount of oxygen consumed is then a measure of the amount of organic material in the water.

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At the end of five days a second dissolved oxygen test should be completed for each sample bottle, and compared with the initial results. Subtract the ppm of oxygen found in the second BOD test from the first test made at the collecting site.

The difference in amount of dissolved oxygen will be a measure of the BOD and will indicate the amount of organic decomposition occurring in the water.

PURPOSE: To determine the quality of natural waters with respect to its O_2 requirement of organic decomposition.

MATERIALS: Those materials contained in Hach Kit Model OX-2P

PROCEDURE:

A. High Range (1 drop = ppm DO)

1. Fill the glass stoppered DO bottle with the water to be treated by allowing the water to overflow the bottle for 2 or 3 minutes. Be certain there are no air bubbles present in the bottle.

2. Add the contents of one pillow each of Dissolved Oxygen 1 Powder (Manganous Sulfate) and Dissolved Oxygen 11 Powder (Alkaline Iodide-Azide). Stopper the bottle carefully so that air is not trapped in the bottle. See Note A. Grip the bottle and stopper firmly and shake vigorously to mix. See Note B. A flocculant precipitate will be formed. If oxygen is present the precipitate will be brownish orange in color.

3. Allow the sample to stand until the floc has settled halfway, see Note E, and leaves the upper half of the bottle clear. Then again shake the bottle and again let it stand until the upper half of the bottle is clear.

4. Remove the stopper and add the contents of one pillow of Dissolved Oxygen 111 Powder (dry acid). Carefully re-stopper and shake to mix. The floc will dissolve and a yellow color will develop if oxygen was present. This is the prepared sample.

5. Fill the plastic measuring tube level full with prepared sample and pour it into the mixing bottle.

6. While swirling the sample to mix, add PAO dropwise, counting each drop, until the sample changes from yellow to colorless. The dropper must be held in a vertical manner. Each drop is equal to 1 ppm Dissolved Oxygen.

7. Repeat this procedure on the same sample after having stored in the dark for 5 days.

8. BOD = first O_2 ppm minus 2nd O_2 ppm

B. Low Range (1 drop = 0.2 ppm DO)

If the result from step 6 is very low, such as 3 ppm or less, it is advisable to test a larger sample so as to obtain a more sensitive test. This may be done by titrating directly in the DO sample bottle as follows:

7. Using the prepared sample left over from step 4 above, pour off the contents of the DO bottle until the level just reaches the mark on the bottle.

8. PAO dropwise, counting each drop, until the sample changes from yellow to colorless. Each drop of PAO added is equal to 0.2 ppm Dissolved Oxygen in the sample.

NOTES:

A. It is a bit tricky to stopper the DO bottle without getting an air bubble trapped in the bottle. To avoid the air bubble, incline the DO bottle slightly, and insert the stopper with a quick thrust. This will force air bubbles out. If air bubbles are trapped in the DO bottle in steps 2 or 4, the sample should be discarded and the test started over.

B. A small amount of powdered reagent may remain stuck to the bottom of the DO bottle at this point, but this will not affect the test.

C. Do not allow the PAO solution to stand in direct sunlight, as it is decomposed by ultraviolet radiation.

D. If DO is to be determined in sewage, pretreatment with Copper Sulfate-Sulfamic Acid is required. Write for instructions. The following items are necessary for this treatment:

1949-00 Cylinder, graduated, 500 ml -- each 7.95
357-13 Copper Sulfate-Sulfamic Acid -- 4 oz DB 1.40
1864-99 Siphon -- each 2.00

Above items also come in a DO in Sewage Test Kit, Model OX-13, Cat. No. 2380-00, each $38.95.

E. In samples that contain high concentrations of chloride such as seawater, this floc will not settle. However, no interference is observed as long as the sample is allowed to stand in contact with the floc for 4 or 5 minutes.

Teachers Curriculum Guide for Field Ecology
Center for Environmental Learning,
Brevard County School Board, 1971.

STUDENT COMMENT NO. 13: Nitrates and Phosphates (Hach Methods)

BACKGROUND: Plants, fish, water, rocks, silt and solid wastes are all easily recognized in natural waters. Chemicals, however creep in unnoticed if they are colorless and odorless. The presence and source of chemicals can be detected by testing the water. Possible sources and effects of several chemicals found in water are listed in Table 1.

Table 1

Possible Sources and Effects of Several Chemicals Found in Water

Chemical	Possible sources	Effect of excess	Standard natural concentration at site
Ammonia Nitrogen	Decomposition of organic matter Fish urine	Increases bacterial growth Reduces growth of fish Increases oxygen consumption of fish,	
Nitrate	Fertilizers Decomposition of organic matter Industrial acids	Increase growth of algae and higher plants Possible cause of "blue babies" in certain concentrations	
Phosphate	Fertilizers Household detergents Organic matter	Increases algal growth	

Phosphates and nitrates are normal components of all natural waters. Moderate quantities of these compounds are required for the normal growth of aquatic plants, terrestrial plants, and algae. Excessive amounts of these chemicals are often found in polluted natural waters resulting in the hypernutrition (eutrophication) of the algae or aquatic plants. This overfeeding, or fertilization, usually results in increased plant growth, an algae "bloom" or a weed choked body of water. Since most organisms utilize oxygen for respiration, the overgrowth of weeds or algae will compete with fish for oxygen often resulting in a massive fish kill. Eutrophication often results in the "death" of the body of water filling it with dead aquatic plants and killing its aquatic animal life. See a text and study the nitrogen cycle for a thorough understanding of the role of nitrogen in the ecosystem.

Bacteria can convert nitrogen as follows:

Organic Nitrogen ——→ decay ——→ Ammonia ——→ Nitrite bacteria ——→ Nitrite ——→ Nitrate bacteria ——→ Nitrate

PURPOSE: To learn how to determine the amount of nitrate, nitrite, and ortho phosphate in water for the purpose of making such tests on samples collected at school or home study sites.

MATERIALS:

Hach kit Model N1-10 (Nitrate-Nitrite Test Kit)
Hach kit Model PO-19 (Phosphate Test Kit)

PROCEDURE: Total Nitrate-Nitrite (does not include ammonium or organic nitrogen).

PART 1: Nitrate - Nitrite

1. Fill one of the color viewing tubes about halfway to the lower mark with demineralized water. Stopper and shake vigorously. Empty the tube and repeat the procedure.

2. Fill the pipette by suction to just above the constriction, with the water sample. The tip of the pipette is then wiped clean and the excess liquid allowed to drain, automatically stopping at the constriction. For best results, rinse the pipette several times with the sample. Blow to discharge the sample from the pipette into the rinsed color viewing tube.

3. Fill the color viewing tube to the upper mark (10 ml) with demineralized water.

4. Add the contents of one Vitra Ver IV Powder Pillow, stopper the tube and shake vigorously for one minute. If nitrate and/or nitrite is present, a pink color will develop. Allow an additional 3 minutes for full color development.

5. Insert the tube containing the prepared sample in the right hand opening on top of the color comparator.

6. Fill the second color viewing tube to the lower mark with demineralized water and insert it in the left hand opening of the color comparator.

7. Hold the color comparator up to a light, such as the sky, a window, or a lamp and view through the openings in front. Rotate the color disc until a color match is obtained. Read the ppm Nitrate Nitrogen (N) and/or Nitrite Nitrogen (N) from the scale window. (See Note A.)

Medium Range (o-10 ppm Nitrogen)

1. Same as step 1 above.

2. Rinse the plastic dropper with the sample or with the pretreated sample, then fill to the 1.0 ml mark. Add it to the rinsed color viewing tube.

3-7. Same as steps 3 through 7 above, except that the scale reading is divided by ten to obtain the ppm Nitrate and/or Nitrite Nitrogen (N) in the sample.

Low Range (0-1 ppm Nitrogen)

1. Rinse a clean color viewing tube with some of the water to be tested, then fill it to the upper mark with the water sample. No dilution is required.

2-5. Same as steps 4 through 7 above, except that some original water sample should be used instead of demineralized water in step 6 if there is color and/or turbidity in the water itself and in step 7, the scale reading is divided by one-hundred to obtain the ppm Nitrate and/or Nitrite Nitrogen (N) in the sample.

PART II: Phosphate

High Range (1-50 ppm Orthophosphate)

1. Rinse the plastic dropper several times with the water sample.
2. Fill the dropper to the 0.5 ml mark. Discharge into one of the color viewing tubes, which has been rinsed with demineralized water.
3. Add demineralized water to the 5 ml mark. Swirl to mix.
4. Add the contents of one Phos Ver 111 Powder Pillow for 5 ml sample. Swirl to mix. Allow one minute for color development. If phosphate is present, a blue-violet color will develop.
5. Insert the tube of prepared sample in the right opening on top of the color comparator.
6. Fill the other tube to the 5 ml mark with demineralized water. Insert it in the left opening of the color comparator.
7. Hold the color comparator up to a light such as the sky, a window or a lamp, and view through the two openings in the front. Rotate the color disc until a color match is obtained. Read the ppm phosphate (PO_4) from the scale window. (See Note B.)

Low Range (0-5 ppm Orthophosphate)

1. Fill both color viewing tubes to the 5 ml mark with the water sample.
2. To one of the tubes, add the contents of one Phos Ver 111 Powder Pillow for 5 ml sample, and swirl to mix. Allow one minute for color development. If phosphate is present, a blue-violet color will develop.

3. Insert the tube of untreated water sample in the left opening of the color comparator.

4. Hold the color comparator up to a light such as the sky, a window, or a lamp and view through the two openings in the front. Rotate the color disc until a color match is obtained. Divide the reading in the scale window by 10 to obtain the ppm Phosphate (PO_4).

NOTES:

A. The color should be compared after one minute but before two minutes.

B. To obtain the value as ppm Phosphorus (P), divide the Phosphate (PO_4) value by 3.

REFERENCE:

Hach Chemical Company
Box 907
Ames, Iowa 50010

STUDENT COMMENT NO. 14: The Determination of the Salinity of Sea Water: Titration Method

BACKGROUND:

The laboratory determination of the salinity via precipitation of the silver halides to an end point is a standard method. The "wet chemistry" process involved is titrametric. Although the experimenter may not appreciate the fine points of titration, he can easily detect the color change, measure the titrant used and correctly apply the table furnished.

Students should be made thoroughly aware of the safety problems to be encountered in any exercise wherein chemicals are employed. Silver nitrate spillage must be cleaned, rinsed and dried. Tall burets filled with titrants topple easily. The resulting mess is often wide-spread.

Overflows and spillages over the top of the buret are at eye-level or above. Eyes must be protected at all times (see appropriate Florida law).

Once silver nitrate is prepared, deterioration of the solution begins with exposure to light, evaporation and air borne contamination. Many chemical laboratories are "rich" in HCl, H_2S and NH_4OH (NH_3) fumes. These dissolve in the opened silver nitrate to form sediments and ionic materials. Some are interferences to good end point determinations.

The end point mechanism is that silver chloride is quantitatively precipitated before the red colored silver chromate is formed. Clumps of precipitate tend to form "refuges" for the chloride ion and the silver ion to interfere with a sharp determination. These clumps should be reduced by vigorous agitation periodically. The addition of 2 or 3 small plastic beads to the reacting vessel will be helpful to break clumps.

Although the pH of the sample is not made a part of this exercise, good results require a pH of 7 - 10. Adjust samples of pH below 7 with 0.1N NaOH.

The student must be able to read the meniscus in order to correctly do this exercise.

Preparation of the $AgNO_3$ titrant:

Measure 27.25 grams of crystalline $AgNO_3$.

Dissolve the crystals in approximately 0.5L of ion-free water (distilled). Be sure all crystals have completely dissolved. Fill with more ion-free H_2O to the one liter mark.

This solution must be stored in a dark brown bottle. If several bottles are used, the contamination of one will be a lesser problem. Each buret filling requires about 50ml of $AgNO_3$ solution. One liter will fill 20 burets (with care).

Preparation of the K_2CrO_4 indicator:

Add 5 grams of K_2CrO_4 yellow crystals to 100 ml of distilled H_2O.

MATERIALS:

1. 50 ml buret
1. 125 ml Erlenmeyer
$AgNO_3$ titrant solution
K_2CrO_4 indicator solution
Phenolphthalein (consult instructor before using)
NaOH (consult instructor before using)
Distilled H_2O
2. 50 ml beakers
1. 10 ml pipet

PROCEDURE:

1. Clean glassware and careful operations are essential. Begin by assuming that the table-top has been contaminated with silver nitrate by the previous class. Although $AgNO_3$ is colorless, skin will turn black in sunlight where $AgNO_3$ is present.

Dampen a paper towel with H_2O. Wipe work area with the wet towel, then dry. Each should wear his apron throughout the laboratory exercise. Wear safety goggles always while in the laboratory area.

2. Fill the buret with distilled H_2O. Drain buret in short spurts. Try to adjust the stopcock so as to deliver drops and a single drop on demand. Now is the time to learn the idiosyncrasies of the stopcock. Be sure it operates without leaking.

The instructor should be informed about an inoperative buret assembly immediately.

3. Pipet 10ml of saline (sea) H_2O into the 125ml flask. Add about 10ml of distilled H_2O. Add 2 or 3 plastic beads.

4. Put 4-6 drops of K_2CrO_4 into the flask. This is the indicator.

5. Fill a 50ml beaker with $AgNO_3$.

6. Pour about 5 ml of $AgNO_3$ into the buret. Drain into the other 50ml beaker. Pour this into sink.

7. Partially fill the buret with $AgNO_3$. Turn stopcock to fill the top. Continue to fill the buret until there are at least 40ml of $AgNO_3$ within the graduated scale. It is not necessary to fill the buret exactly to "O" or exactly "50" (the top reading). This is time consuming.

8. Record the reading at the start (read Meniscus). The buret either has "50" or "O" or both as the top graduation. In either case, record the start and end graduations. Subtract the smaller from the larger to find the volume of $AgNO_3$ used in milliliters. Most burets can be read to the tenth of ml.

Touch the hanging last drop in the buret with the rim of the flask so it will run into the liquid.

10. Agitate the flask. DO NOT LOSE ANY LIQUID--to make sure, use a stopper.

11. Repeat steps 9 and 10 until the first pink-orange color appears.

12. Agitate well. The clumps of precipitate must be reduced to very small particles. The flask contents should return to the original color.

13. Add $AgNO_3$ drop by drop while agitating the flask contents sufficiently to keep the precipitate particles small. When the pink color reappears, "catch" the hanging drop. Stopper. Shake vigorously. If the pink color remains, this is the end point. Otherwise, repeat Step 13.

14. Once the end point is reached calculate the volume of $AgNO_3$ used. (See 8). **THIS IS THE SALINITY.** However, a correction may need to be applied--consult the table below.

Salinity Corrections (Harvey, 1963)*

Salinity, S 0/00 found	Correction to be applied	Salinity, S 0/00 found	Correction to be applied
40	-0.15	22	+0.22
38	-0.08	20	+0.23
36	-0.03	18	+0.23
34	+0.03	16	+0.23
32	+0.07	14	+0.20
30	+0.11	12	+0.19
28	+0.15	10	+0.16
26	+0.17	8	+0.15
24	+0.20		

*Reprinted by permission of Cambridge University Press, from the Chemistry and Fertility of Sea Waters, by H. W. Harvey, 1963.

15. Collect salinity results from other teams and make a table showing salinity for all sites.

STUDENT COMMENT NO. 15: Counting and Collecting Instructions

Each specific inspection team is to make their own record of their field site. Following are some directions for completing the record:

1. Stake out the collecting site (Student Comment No. 7, page 47).

2. Begin at one corner of the site and count the different animals/plants that are found. It is not necessary that you know their names, but make sure to distinguish between them.

3. Make a collection of each plant found. Take only one of each plant, tag it, and wrap it in wet newspaper. For large plants take only a small section. If it is flowering try to collect the flowers. Do not place any plants in your mouth as some may be poisonous.

4. Make a collection of animals found, but take only one of each species. Use one jar for each specimen collected. Label each jar. Do not attempt to collect large or harmful species.

5. Place animal/plant specimen into collection box. Be careful not to lose tags or crush plants.

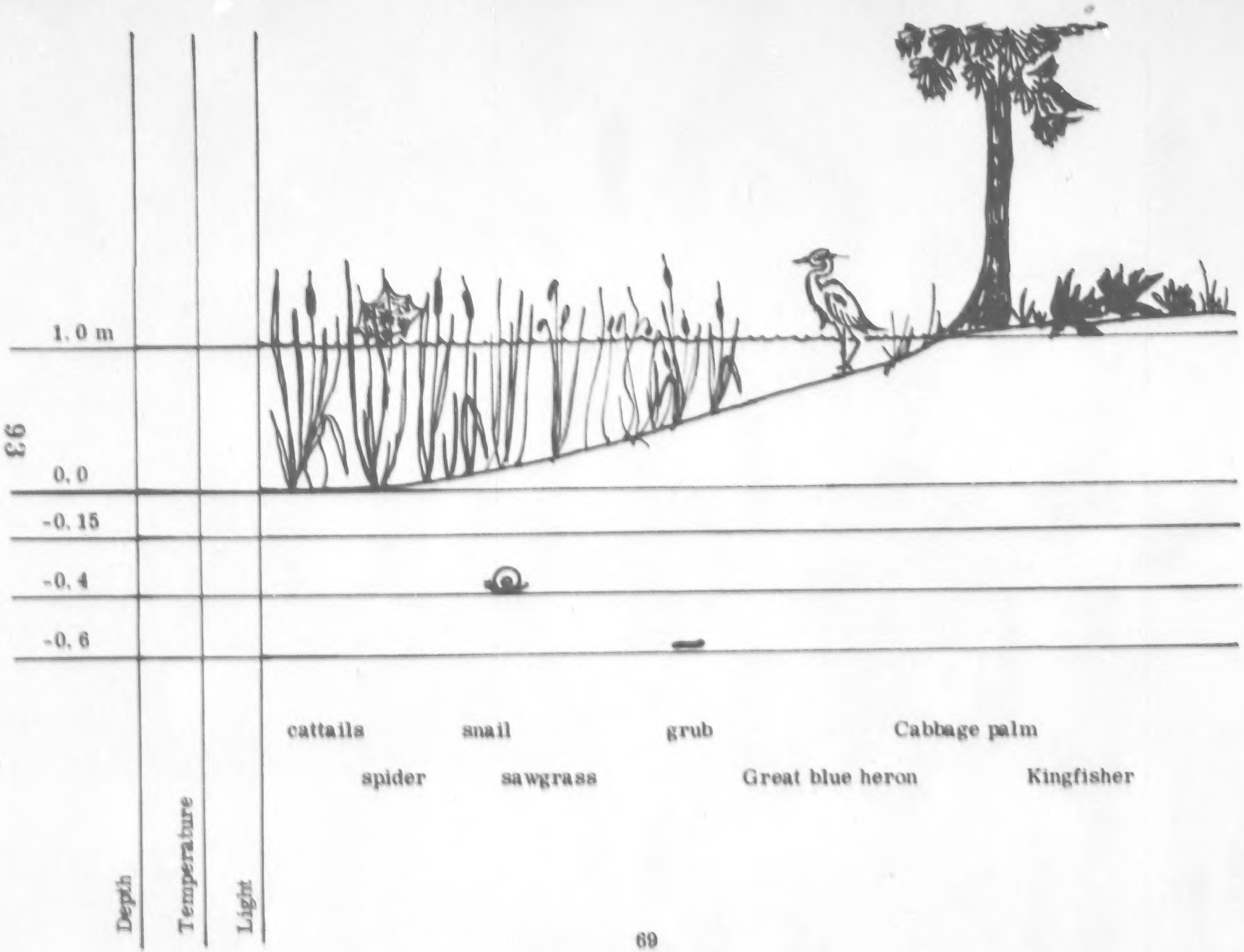
6. Contact general inspection team and request they photograph plants/animals too large to collect.

STUDENT COMMENT NO. 16: Procedures for Making a Vertical Drawing of a Site Investigation

Procedure: Starting at the lowest core level make a scale drawing of the area studied.

1. Show the depth of each layer of soil.
2. Show the depth of water.
3. Show the plants that were found and the heights they were found.
4. If any organisms are found, put them into the drawing at the proper vertical spot (stratification).
5. On the left hand side of drawing show the scale height, changes of temperature at increasing heights, changes of light intensity with increases in height.
6. Along the bottom identify the organisms shown in the drawing.

All measurements should be done in the metric system. The scale drawings should all be done to the same scale so that they can be put together at the completion of the investigation. Follow the example on the next page.


1.0 m
0.0
-0.15
-0.4
-0.6
Depth
Temperature
Light
cattails
snail
grub
Cabbage palm
spider
sawgrass
Great blue heron
Kingfisher

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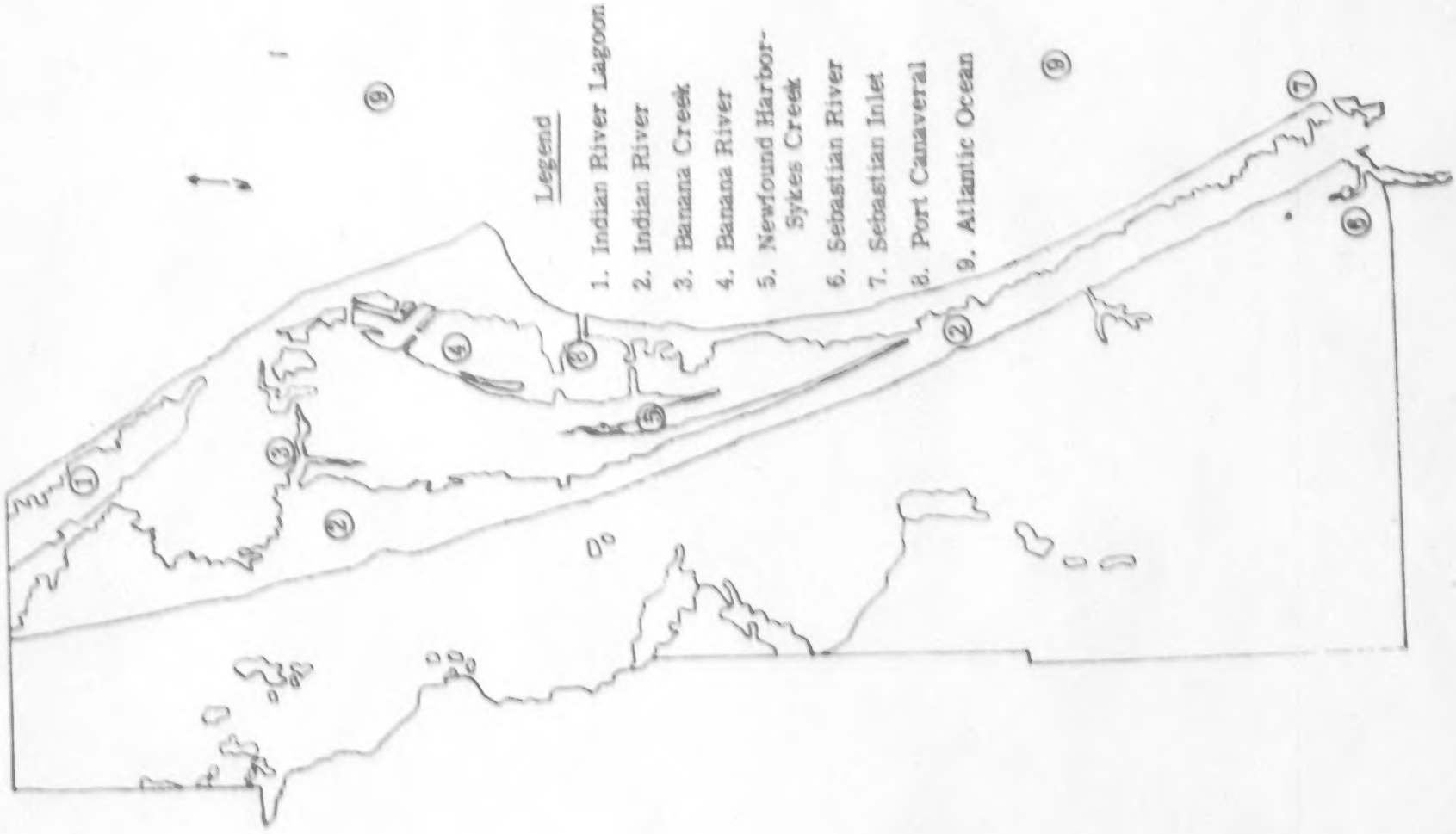
STUDENT COMMENT NO. 17: Map of Brevard County



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STUDENT COMMENT NO. 18: Florida Outline Map

STUDENT COMMENT NO. 19: Plant Life in the Everglades

Many different species of plants thrive within the confines of Everglades National Park and in adjacent regions. The characteristics of these plants are determined largely by three factors: hydrological factors, geological influences and temperature, which averages 68° in winter and 80° in summer.

Southern Florida may be divided into three major regions according to the nature of the dominant vegetation. The first region is the "true Everglades," a sawgrass swamp which covers most of the southeastern corner of the state. This area resembles a Kansas wheat field flooded by several feet of water. The vast sawgrass sea is interrupted by occasional stretches of pine forests and tree islands known as hammocks. Hammocks form in two ways: on naturally occurring patches of higher ground where the marl (clay) is thicker and higher than the surrounding marsh, and in depressions in the marl where decaying plant material has become peat, a rich soil nutrient for small plants which later give way to trees. Hammocks usually contain tropical hardwood trees such as mahogany, a wide variety of palms, and many other species, including a number of northern type trees such as oaks and maples. Along the forest floor grow ferns, orchids, ivies and fruit-bearing shrubs, forming a lush tropical oasis. Hammocks also provide an excellent environment for many species of wildlife.

Another factor which has influenced the development of the hammocks and sawgrass ever since Indians first inhabited the area is fires. During the dry season an Everglades fire is a savagely destructive force.

The sawgrass swamp is one of the most richly productive vegetative regions in the world. A measurement known as the "net primary productivity per unit area" is used to determine how much vegetation is produced. It is defined as the number of dry grams of green plant matter produced per square meter per year. In the sawgrass swamp this figure averages about 2000. In comparison, a temperate zone forest produces 1500, a cow pasture 500 and a desert 30. The average figure for the entire earth is 320. The only areas

which can compete with the marsh for richness of vegetation are estuaries, tropical forests and farmland managed scientifically.

The second major region in southern Florida lies to the west of the sawgrass swamp. Known as the Big Cypress Swamp, it is not within the boundaries of Everglades National Park. Around the turn of the century the most magnificent cypresses in the country grew here. Some were more than 15 feet in diameter at the base. Few of these giant trees remain; they were sacrificed to an unregulated timber industry. Nevertheless, the Big Cypress Swamp remains a vital part of the ecology of South Florida. Many species of birds and animals live in this area, which serves as an excellent breeding grounds. Some are on the Bureau of Sport Fisheries and Wildlife list of rare and endangered species. Among these are the wood ibis, the roseate spoonbill, the southern bald eagle, the Cape Sable seaside sparrow, the panther and the alligator.

The third region is found at the southern tip of the state where the waters of the Gulf of Mexico intermingle with the fresh water of the swamps. The dominant form of vegetation in this area is the mangrove tree. The red mangrove, one of the species found in the park, is equipped with a unique means of propagation. Water seedlings with a simple root system already formed drop from the parent plant into the water, where they float until they reach water shallow enough to take hold in the mud. In places the mangrove groves are so dense and intricate that canoeists have become lost for days.

-- Harte, John and Socolow, Robert, Patient Earth, Holt, Rinehart and Winston, Inc., New York, 1971. "The Everglades Dominant Plant Vegetation," pp. 186-188.

STUDENT COMMENT NO. 20: Outline Map of South Florida

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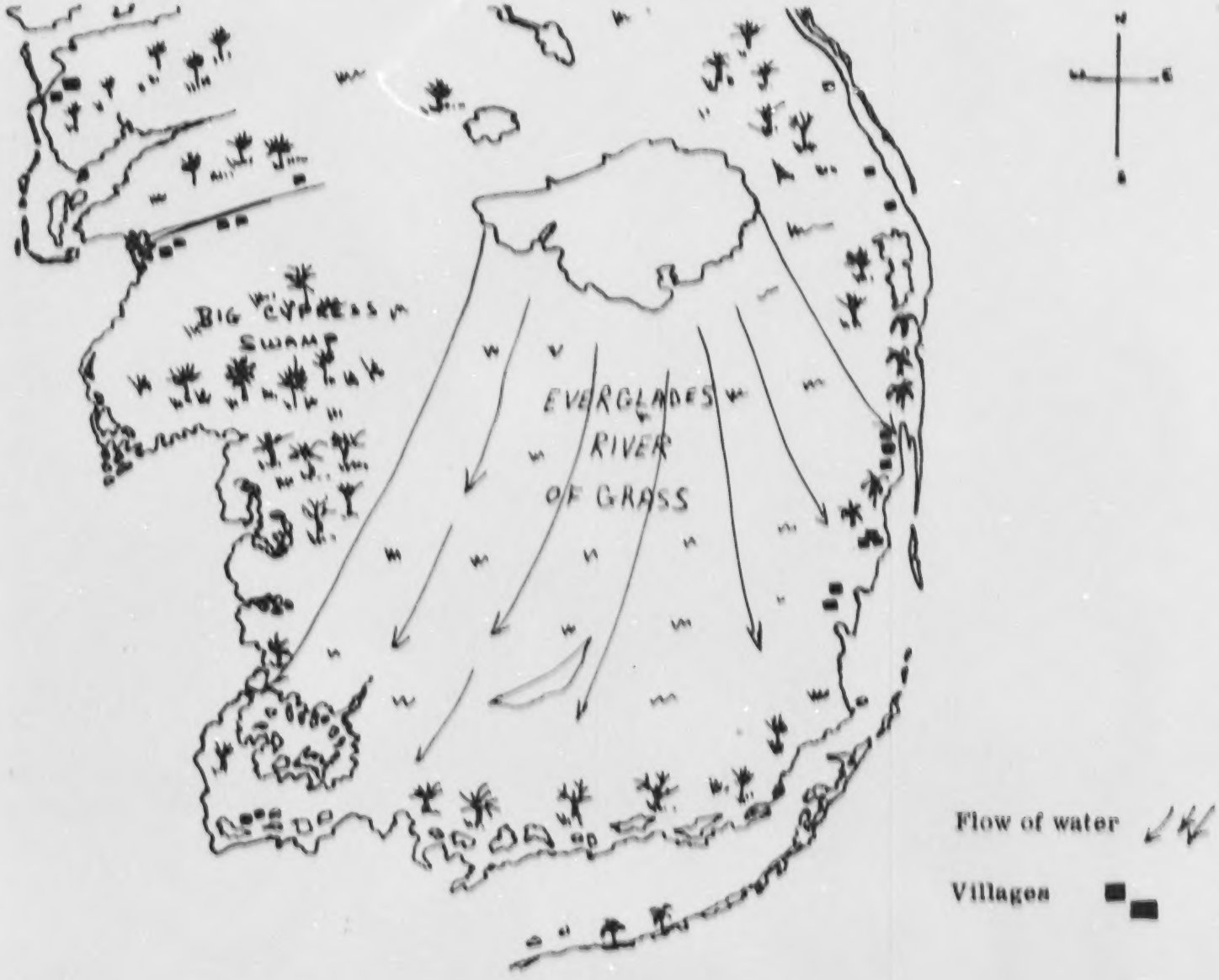
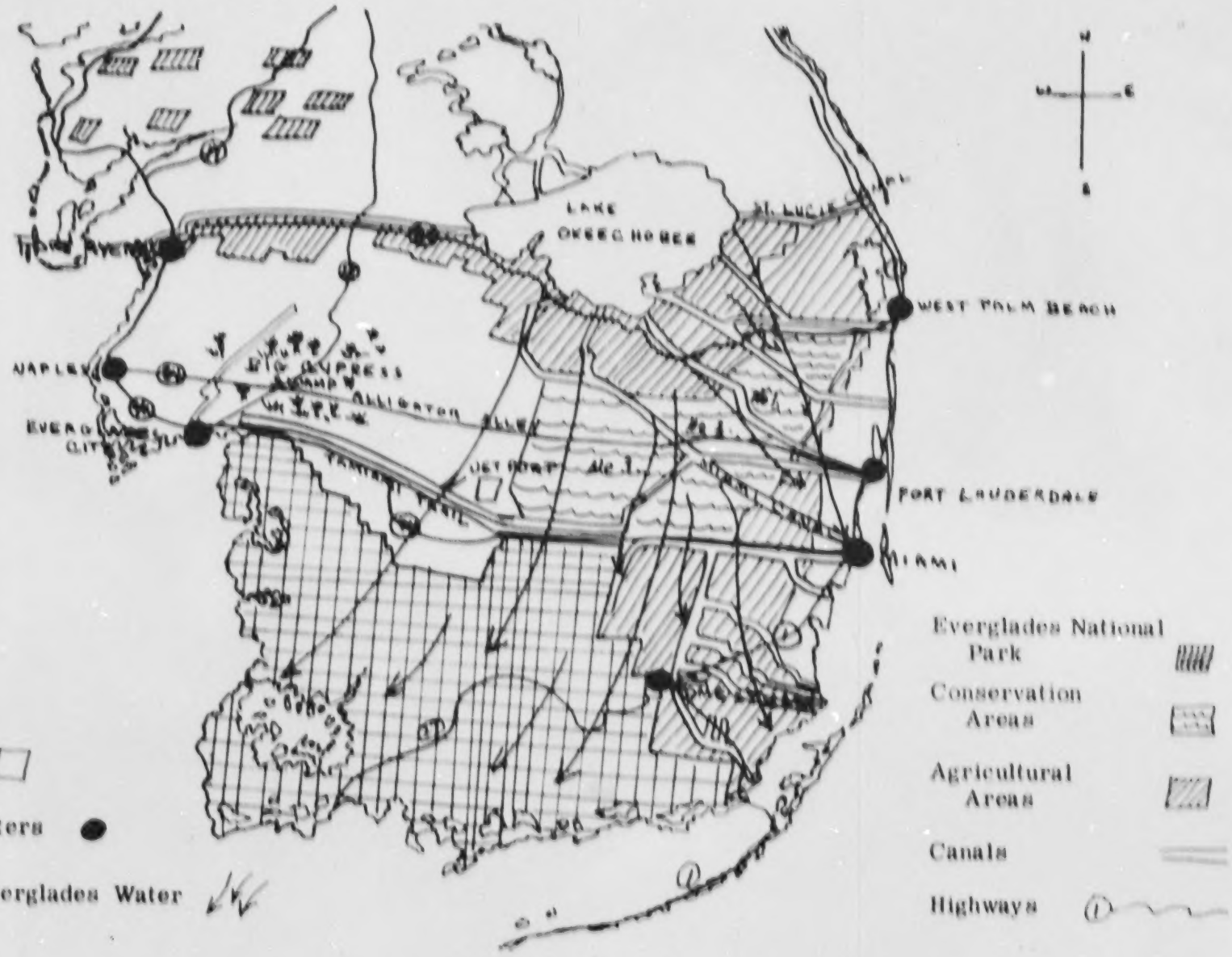
STUDENT COMMENT NO. 21: 1871 Map of Everglades



66

STUDENT COMMENT NO. 22: 1971 Map of Everglades



1.50

STUDENT COMMENT NO. 23: Can the Everglades Survive?

The Everglades National Park is, of course, protected against direct development. But what many don't realize is that the park itself is utterly dependent ecologically upon the regions adjacent to it, especially the large swamp of peat and muck known as the Upper Everglades which stretches across the state to the north of the park itself. The organic soils in the Upper Everglades are capable of absorbing and detoxifying large quantities of pollutants such as persistent pesticides and toxic metals from the waters which drain southward from urban and agricultural developments into the swamp. This area serves as a critical buffer zone. It decontaminates the polluted water and feeds clean water into Everglades National Park to the south. In addition, the spongy muck holds water during the wet season and then gradually releases during the dry season, thus serving as a delicate natural filtration network for the entire ecosystem of South Florida.

Now the Upper Everglades are rapidly being drained for economic development, both to reap bountiful crops from the rich organic soil (until it is depleted) and to build new communities for one of the most rapidly growing states in the nation. As a result, the vital beds of muck and organic soils are being systematically destroyed. In the last 50 years, 40 percent by volume of organic soils in the Upper Everglades has been destroyed. Exposed to the atmosphere by draining and farming, the muck has been eroding rapidly. In the Okeechobee agricultural area, the thickness of the muck has dropped five feet in the last 44 years. It is expected to be depleted entirely by 1990. As this critical buffer zone is destroyed, pollutants from urban and agricultural areas will flow directly into the Everglades, unimpeded. Inevitably, the park will be destroyed also, unless an immediate effort is made to preserve the ecology of the ENTIRE area, not just the federally-protected parkland.

-- The Florida Naturalist, Vol. 43, No. 4; Oct. 1970.

-- "Can the Everglades Damage Be Repaired?", The Florida Naturalist, Vol. 11, No. 1; Oct. 1971.

STUDENT COMMENT NO. 24: The Frontier Spirit in the Everglades

Florida was admitted to the Union in 1845. Some 70 years later real estate speculators from the north finally began to recognize the area's vast economic potential. In 1915 the Everglades swamp beckoned as a frontier to these fortune-hunters. Plans were drawn up to drain the swamp and create a "Garden of Eden" of fertile farmland. The drainage projects began. The sawgrass along the perimeter of the swamp was drying up under the hot sun. Farmers began to till the rich black peat.

As the area began to develop, there was increasing demand for a trans-Everglades highway to link the Miami area with the Gulf Coast. The proposed thoroughfare was dubbed "Tamiami Trail" by promoters, and the name caught on. A bond issue of $275,000 was passed. Construction began in 1916. The enormous enthusiasm which marked the early stages of the project began to wane, however, when it became evident that the original financial appropriation was hopelessly inadequate. Building a hundred miles of roadbed through the dense sawgrass and cypress swamps proved to be a Herculean endeavor indeed! The task was further delayed by World War I and all but shelved entirely in the aftermath of the devastating Miami hurricane of 1926. (See Student Comment No. 25, "Nature Strikes Back," p. 80). The vicious storm halted, at least temporarily, the Florida boom. Then a new governor was elected, and the project was revived. The Tamiami Trail was finally completed in 1928 after 13 years of strenuous effort and at a total cost of some $7 million -- 29 times the amount allocated in the original bond issue! Few motorists who whiz along this black ribbon through the swamp today realize that effort and frustration went into its construction.

About 40 years later a second highway was constructed about 25 miles north of and running parallel to the Tamiami Trail. The new road was named Alligator Alley.

While the Tamiami Trail was still under construction, a political "hassle" developed between competing real estate interests as to which route the road should follow. It was originally to pass through

Monroe County -- in fact some of the roadbed had already been constructed there -- but after the power struggle the route was changed to transverse Collier County instead, to the north.

Everglades visitors today can benefit from the furor generated over the Tamiami Trail. Twenty-four miles of the original roadbed in Monroe County became a secondary route (Florida Highway 94) which offers a fascinating side trip into the heart of the swamp. The gravel surfaced Route 94 offers a much closer look at the Everglades vegetation and wildlife than the high-speed Tamiami Trail. It also leads to places where enterprising motorists can disembark and explore roadside hammocks for wild orchids and air plants.

-- Sand, George X., The Everglades Today - Endangered Wilderness, Four Winds Press, N.Y., 1971, Chapter 9, "The First Road Into the Swamp," pp. 141-149.

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STUDENT COMMENT NO. 25: Nature Strikes Back

Almost inevitably when man decides to "improve" on nature, he ends up making a mess of things. Such has been the case in southern Florida ever since the first settlement shortly after Florida joined the union in 1845. Settlers discovered that incredibly large, choice-quality vegetables would spring up in a matter of weeks from the rich black soil in the Everglades. Bright red tomatoes as big as melons and firm green cabbages as big as washtubs sprouted up almost without effort. But first the settlers had to cope with a little problem -- the thin layer of drainage water from Lake Okeechobee which blanketed the fertile peat that had taken thousands of years to accumulate. In their zeal to exploit the "black gold", farmers sought a means of draining the land.

Before man intruded, nature had created an ingeniously simple and effective watershed on the Florida peninsula. Almost all of the 60 inches of rain which descends upon the region during the spring and fall wet seasons flows southward down the peninsula through an intricate interlacing network of rivers, streams and lakes. The main artery is the Kissimee River, which empties into the north end of Lake Okeechobee. The lake serves as an immense catch basin for the entire region. From it, overflow waters seep into the Everglades to sustain its delicate life cycle and protect the precious peat.

Settlers who had difficulty draining the land began to exert pressure upon legislators. In 1850 Congress passed the Swamp Land Act, which made possible the transfer of large tracts of federal land to the states, to be used for the benefit of all citizens. Much of the Everglades thus became the property of the state of Florida. To assure that the area be developed sensibly, the Florida legislature in 1855 established the Internal Improvement Fund. A "watchdog" committee was set up to monitor the sale of public lands to private individuals. However, the IIF did not keep its trust to the citizens of Florida in those pioneer days, and it never really has fully discharged this responsibility. Originally the Everglades swamp covered some

2,746 square miles. Now only 1,537 square miles remain in a relatively natural state, and the area is still shrinking.

The Civil War temporarily interrupted the plans of settlers to drain large areas of the Everglades for agricultural purposes, but by 1906 dredges were carving up the terrain. The "battle plan" was to cut several deep drainage canals to drain water from Lake Okeechobee into both the Atlantic Ocean and the Gulf of Mexico. To make sure the lake would never again overflow, an earthen dike was constructed along the southern shore.

ECOLOGICAL "BACKLASH"

The drainage project succeeded in exposing the rich black soil to the air. Farmers moved in eagerly, but to their chagrin they learned an early lesson in ecology. In a vast ecological "backlash" which has continued to this day, the Everglades protested against its intruders. First, the rich soil, baked dry by the sun (which had never been able to penetrate the naturally protective layer of water that man drained off), began to blow away in dense brown clouds. Ironically, much of the prized "black gold" began to wash away in the poorly-designed drainage canals. And what didn't blow away or wash away began to catch fire, sometimes from spontaneous combustion within the peat. Developers looked on in frustration as the peat began to shrink. As much as five feet disappeared in the first five years. The peat has continued to erode ever since. Conservationists estimate what remains will be lost forever within 30 or 40 years. Nor was farming as Utopian a task as the ads the real estate developers placed in newspapers across the country would have prospective farmers believe. Clearing the land of the saber-sharp sawgrass was a difficult, costly and sometimes impossible task. Even when the land was cleared successfully, farmers discovered that after one or two bumper crops the soil became depleted. Only with expensive fertilizers could additional farming be successful.

The damage done by the drainage canals was irreparable. Fires caused by lightning, careless people and spontaneous combustion raged out of control where once they had been controlled naturally by the surface

water in the swamp. Beautiful islands of trees were destroyed in seconds. Black smoke hung like a pall over the Everglades. Thousands upon thousands of fish died in slimy stagnant pools which had once contained crystally clear water. Deer fled, following the bear, panther and long-legged birds that had already departed. The Seminole Indians were thus deprived of two of their major sources of food. Even though man has attempted to repair some of this damage today, he has never been completely successful. Perhaps the most dangerous "backlash" of all was the threat of salt-water intrusion along the East coast. As the level of fresh water became depleted, ocean water began to filter in through the pores in the coastal ridge of limestone, poisoning the water supply of cities along the coast.

THE FURY OF NATURE

The would-be exploiters of the Everglades were paying a bitter price. The punishment, it seemed, was contained in the crime. But in the 1920's it seemed almost as if nature was exacting further payment from the humans who had ravaged the swampland. In September, 1926, a violent hurricane struck the southern portion of Florida. Packing winds of up to 135 miles per hour, the storm churned Lake Okeechobee into a frothing cauldron which surged relentlessly against the tiny dike at the southern end of the lake. The great waves washed through the dike at the southwest shore and carried away the flimsy frame houses of the farmers in the vicinity of Moore Haven. The occupants struggled futilely. Their terrified screams were muffled by the fury of the storm. Many were washed into the fields they had farmed that afternoon and were never seen again.

Still, man clung tenaciously to the perilous south shore of the lake. An earthen levee about seven feet high was constructed along the shore. Life went on. Then, almost two years to the day from the first hurricane, a second and even more devastating storm struck Lake Okeechobee on September 16, 1928. This time the direction of the wind funneled the fury of the lake toward the weakest link -- the southeast corner, where 6000 people lived, protected only by the 7-foot levee. Frenzied by winds of up to 150 miles per hour,

the waters smashed through the barrier as if it were a sand castle on the beach and raced in a vast tidal wave across the flat land.

Men fighting to save their possessions were lifted off the ground by the screaming wind and hurled into the darkness. The wind was so strong it drove fragments of boards clear through tree trunks. Women and children clung in terror to the roofs of floating h[illegible]ses, but they often found they had to share their haven with equally terrified poisonous snakes trying to escape the flood. Weakened and dizzied by snake bites, many lost their grip and perished in the waves. When the hurricane finally subsided, bodies floated in all directions. Some were never recovered, entombed in the muck they had hoped would make their fortunes. Rescue teams had to pile unclaimed corpses in funeral pyres to be burned before they bred disease. Black smoke again draped the Everglades.

(The story of this region of the Everglades is continued in Student Comment No. 27 , "The Everglades - Dying of Thirst?", p. 87).

107

-- Sand, George X., The Everglades Today - Endangered Wilderness, Four Winds Press, N.Y., 1971, Chapter 8, "Man's Intruding Hand," pp. 133-139.

STUDENT COMMENT NO. 26: The Battle for Water in Southeast Florida

Supplying water for southeastern Florida is one of the most complex environmental problems in the nation. During the rainy spring and fall seasons, there is too much water, threatening farms and homes with floods. During the dry summer and winter periods, there is too little water, bringing danger of drought. To regulate the water supply in the area, the Army Corps of Engineers has constructed an intricate network of canals, dikes and drainage gates which criss-cross the eastern half of southern Florida like a vast cobweb. The system is administered by the Flood Control District. It can drain water from Lake Okeechobee to lessen the danger during flood season, let it stand on the ground, and later release it during the dry season. The underground pressure from the accumulated water protects the coastal water supply against invasion by salt water through the coastal limestone ridge.

There are three major interests competing for the water in the Flood Control District -- the rapidly growing metropolitan Miami-Fort Lauderdale-Palm Beach urban complex; agricultural interests (especially citrus growers), and the Everglades National Park to the south, which has been cut off from much of its natural water supply by the man-made system. Difficult priority decisions must be made when the supply of water is limited. The densly populated coastal area, which now packs over a million people into a narrow strip of land which contained less than half that number in 1950, places heavy demands on the water supply. Farmers are almost totally dependent upon irrigation to carry their crops through the dry season. Cities and farmers can talk. The Everglades cannot. This essential difference was probably a major factor in the decision of the FCD to virtually shut off the flow of fresh water to the Everglades in the dry years of 1961 to 1965. Considerable damage was caused to plants and animals in the park (See Student Comment No. 27, "The Everglades - Dying of Thirst?", p.87). The cities and the agricultural interests received an ample supply of water. The park got nothing.

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What will happen if the population of southern Florida continues to grow? By the end of this decade, it will probably be necessary to choose between a water shortage in Miami, a reduced crop yield in the citrus groves, and drying up the Everglades. The pressure will first be felt in dry years, eventually in wet years as well. By the end of the 1980's, there may not be enough water to meet ANY of these demands without going to outside sources far away, at great expense. This warning is sometimes difficult to get across to the public, however, especially when it sees pictures of the Everglades covered with water during the rainy season. But the danger is real, and almost immediate.

RECYCLING OF WATER: A POTENTIAL SOLUTION

One solution to the problem is re-cycling water for multiple use. Fields could be irrigated with waste water from cities; bath water could be cycled through air conditioning units, etc. However, multiple use is only practical when each successive use requires a lower degree of water quality. Water deteriorates with each use. The only alternative would be to install treatment facilities at an intermediate step to re-purify the water. The cost of such facilities, at present, would be prohibitive, but the development of a quick, inexpensive large-scale treatment process would be a tremendous asset to water conservation methods. Such a development would be essential for the Everglades to benefit from re-cycling projects, because the finely-balanced ecology of the swamp requires water of even higher quality than that necessary for public water supplies. (See Student Comment No. 28 "The Problem of Water Pollution in the Everglades," p. 92). If water used to irrigate citrus groves were diverted from there to the Glades, the nitrates, phosphates and pesticides it had picked up would poison the park. In supplying water to the Everglades quality is just as important as quantity, a consideration which is certainly not going to work in favor of the park in the allocation of water resources in years ahead.

The Army Corps of Engineers has consistently demonstrated that the Everglades takes lowest priority in the distribution of water. Practically the only hope for the endangered tropical wilderness, therefore,

lies in the avenue of Congressional legislation. Since the federal government appropriates funds to the Corps, it has some influence on how the FCD apportions its water. In June, 1970, Congressmen concerned for the future of the Everglades passed a law establishing quantitative guidelines to guarantee at least a minimal annual water supply for the Everglades:

> Delivery of water from the central and southern Florida project to the Everglades National Park shall not be less than 315,000 acre feet annually, prorated according to the monthly schedule set forth in the National Park Service letter of October 20, 1967, to the Office of the Chief of Engineers, or 16.5 per centum of total deliveries from the project for all purposes, including the Park, whichever is less. (Public Law 91282, Section 2).[1]

Nevertheless, even a legal formula for water distribution will not save the Everglades if the population of the coastal area continues to skyrocket. The ecology of the area has already been strained to the breaking point; there is simply not enough water to go around. Further development of southeastern Florida will almost certainly sound the death knell for one of the nation's most beautiful and unique national parks.

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-- Harte, John and Socolow, Robert H., Patient Earth, Holt, Rinehart and Winston, Inc., New York, 1971. "Competing Demands for Water in Southeast Florida, pp. 195-197.

Notes:

[1] p. 196

STUDENT COMMENT NO. 27: The Everglades - Dying of Thirst?

As ironic as it seems, the greatest problem facing the majestic swamp at Florida's southern tip is lack of water. How could a swamp, of all places, have gotten into such a predicament? The story dates back to the disastrous hurricane of 1928 which demolished the communities on the southeastern shore of Lake Okeechobee (See Student Comment No. 25 "Nature Strikes Back," p. 80).

The national outcry which followed the hurricane of 1928 paved the way for action at a federal level. Newly-elected president Herbert Hoover made a personal inspection before his inauguration. At his order, early in the 1930's the Army Corps of Engineers began constructing a higher, stronger levee along the entire 80-mile south shore of Lake Okeechobee. It was known as Hoover Levee. Still, the project did not solve the problems caused by the early settlers who had tried to drain the Everglades. (See Student Comment No. 25 "Nature Strikes Back," p. 80). This became evident in 1947 when two severe hurricanes struck the Everglades in rapid succession. The swamp overflowed at its eastern border, causing some $60 million in flood damage to Miami and other coastal cities. Congressmen, supported by the Army Corps of Engineers, introduced a bill calling for the establishment of a Flood Control District. The bill passed in 1949. The project, to cost an estimated $300 million, was to be completed by 1965. Essentially, the plan called for the channeling of water from Lake Okeechobee before hurricane season to reduce the lake to below flood levels, and keeping it in three large reservoirs along the lower east coast, to be pumped out later during the dry season. The storage of the fresh water would protect the cities against salt-water intrusion from the sea and also create much-needed recreational areas. No fresh water was to be wasted. The plan appeared solid in principle, but it was not managed properly. The Corps took 10 years to build the three large impoundment areas for water, and even then the water continued to escape underground through the porous limestone rock at the southern areas of the reservoirs. The water levels were allowed to drop, sometimes disappear completely. As a result, thousands of bass and other choice freshwater

game fish perished. Carrion birds descended upon their carcasses.

CONSERVATIONISTS BLAST ENGINEERS

Conservationists have charged that the Corps of Engineers is merely masquerading under a flood control program while fostering, in actuality, land reclamation designed to make profits for farmers in the gradually-drying Everglades. "Harold L. Ickes, who served as Secretary of the Interior under Presidents Truman and Roosevelt, once charged that, 'No more lawless or irresponsible federal group than the Corps of Army Engineers has ever attempted to operate in the U.S. either without or within the law. . . ' "[1]

The FCD project has made the Everglades dependent upon man to release water during periods of drought to sustain its delicate ecology. By 1965 the park had suffered repeatedly from lack of water. Indignant citizens demanded that the FCD spare the unique national park. Finally, in reluctant response, the flood control agency opened briefly one of its four 6-gate spillways in the Tamiami Trail exactly one inch per week in order to feed fresh water into the Everglades. This amount of water was, of course, woefully inadequate to relieve the drought-parched swampland. One infuriated conservation organization called the FCD's action ". . . as helpful as spitting on a forest fire!"[2] FCD spokesmen retaliated that its critics were ". . . more interested in birds and alligators than people."[3] As the feud continued, the New York Times observed that by holding back water for the benefit of a few Florida farmers, the FCD was threatening a natural resource which belongs to all the people of the United States.

There is no doubt that the FCD has the capacity to provide the Everglades with all the water it needs. During and after Hurricane Donna in 1960 when the entire 16,000-square-mile pumping system was pressed into emergency operation, the system moved nearly half a trillion gallons of water (500,000,000,000). And the Army Corps of Engineers is required by federal law to provide the Everglades National Park with a sufficient supply of fresh water. Yet by 1965 the Everglades appeared to be on the brink of extinction, as the vital water supply was deliberately choked off. Threatened by the slow death of the swamp were 89

different species of birds, 40 reptiles, 40 amphibians and 150 kinds of fish.

A TRAGIC SCENE

Dying animals and birds searched pitifully for water, leaving broken trails in the drying mud where thousands of swollen dead fish were strewn. Vultures circled everywhere. Starving alligators were compelled to go against nature and devour their smaller brothers. Some species such as the otter and raccoon and many species of birds fled the Everglades in desperation, sometimes leaving their young to perish. The little white-tailed Glades deer refused to leave, however. Thousands died in agony from hunger and thirst.

Even during the drought, some water managed to work its way into the Everglades by seeping through the limestone and passing underneath the roadbed of the Tamiami Trail. This water, however, was insufficient both in quantity and quality; it was not nearly enough to revive the entire park, and it lacked the tiny microscopic organisms found in surface water which form the first link in the food chain of the swamp. Different attempts were made to furnish the drying Glades with water without relying on the FCD network. Wells were dug in an attempt to keep certain areas within the park flourishing, but the amount of water tapped was never fully adequate. There was also the threat of tapping high chloride water, which would do more harm than good. Cloudseeding operations using silver iodide have been successful on occasions, but the procedure is too expensive and results too unpredictable to be practiced on a large-scale basis. For all intents and purposes, the fate of the Everglades rested in the hands of the men who controlled the pumps in the South Central Florida Flood Control District. They clung stubbornly to their refusal to open wide the spillways through the Tamiami Trail and relieve the desperate situation in the Glades. The explanation was that the water had to be held back as part of the FCD's water conservation program. The effect of closing the spillways along the Tamiami Trail was to create a massive build-up of water in nearby conservation districts. This effect was increased by the impact of the other trans-Florida highway 25 miles north of

Tamiami Trail, Alligator Alley -- a road without spillways and with fewer than a dozen bridges in the 20-mile section where it cuts through the Everglades drainage route. As a result, in one portion of South Florida, deer and other game animals were being drowned by overflowing reservoirs, while in another section the same species were dying of thirst!

NATURE DEFENDS HER OWN

Nature finally stepped in where man wouldn't. Heavy rains finally ended the 1965 drought. The park was saved. In a bitter touch of irony, however, many deer were drowned during the subsequent wet season, in the same area where animals had succumbed to thirst a few months before.

Despite the terrible impact of the 1965 drought upon the Everglades, the Army Engineers retained their same obstinate attitude when a second drought struck in 1967. Once again the Everglades, supplied with only a small portion of the water available, began to dry up. Once again, birds, animals, plants and fish died by the thousands. This time forest rangers angrily insisted the Engineers honor their legal commitment to preserve natural conditions in the national park. Not only did the Corps and the FCD refuse, but in a move which seemed to border on sheer vindictiveness, threatened to take an action which could destroy the Everglades in one fell swoop! They threatened to "pull the plug" on a controversial canal extension which they had dug through the Everglades earlier (itself a politically-motivated project, conservationists contended), and thus open up the Everglades fresh water system to direct invasion of salt water from the Atlantic Ocean! What the drought hadn't already killed, the salt water most certainly would. Ten miles long and 120-feet-wide, the canal was originally intended to serve as a navigable waterway which would permit barges to transport materials to a plant of the Aerojet General Corporation which had been constructed in the Everglades to test rocket engines. Called the Aerojet Canal (Canal III), the waterway cost $4 million. It was completed except for a small section of earth at the end which blocked out the sea. (Since the excavation of the canal, the

rocket-testing function of the plant has been discontinued.)

NATIONAL PARK SERVICE INTERVENES

Now the Corps made preparations to remove the plug of earth, and flood the Everglades with salt water. That, however, was a little too much, even from the Army Corps of Engineers. The National Park Service protested. When the Engineers turned a deaf ear, the National Audubon Society threatened a lawsuit to safeguard the park against "irreparable damage and destruction."[4] The head of the FCD replied that if the plug were not removed forthwith, the money invested in the construction of the canal would "... be thrown down a rat hole."[5] The director of the National Park Service, George B. Hartzog, wrote a letter to Secretary of Interior Stewart Udall: "I recommend that if the Corps of Engineers of the State of Florida persists in their efforts to remove the existing plug in Canal III, the Department of Justice be requested to take legal action by means of an injunction in remedy of this situation."[6]

The plug was not pulled. Nevertheless, the perilous fortunes of the Everglades during the last decade lead conservationists to wonder what threat will next be levelled at this unique tropical ecosystem. Will it fall victim to an ill-guided "improvement" project? Will it be sacrificed for quick agricultural profit? And most important of all, will it receive enough water to survive in years to come? If the past performance of the Flood Control District and the Army Corps of Engineers is any indication, the troubles of the Everglades are long from over.

-- Sand, George X., The Everglades Today - Endangered Wilderness, Four Winds Press, N.Y., 1971, Chapter 10, "The Water Problem," pp. 151-161.

Notes

[1] p. 153
[2] p. 154
[3] p. 154
[4] p. 161
[5] p. 161
[6] p. 161

STUDENT COMMENT NO. 28: "The Problem of Water Pollution in the Everglades"

There are three primary causes of water pollution in the Everglades -- agricultural fertilizers, urban and industrial sewage and persistent chemical pesticides such as DDT. The first two sources contain nutrients such as nitrogen and phosphorus compounds. When these are washed into the waterways of the Everglades, they cause a phenomenon known as eutrophication, or the sudden heavy growth of vegetation. This sometimes clogs waterways to the point of destroying the natural habitat of creatures such as alligators and many species of fish. In its unspoiled state, the water of the Everglades contains 1.5 parts per million of nitrate ions and 0.1 ppm of phosphate ions. Waste waters from the urban areas of South Florida, even after receiving secondary treatment, contain 20-30 ppm of nitrate ions and 1 ppm of phosphate ions -- 10 to 20 times as much. Therefore, recycling waste water into the Everglades to combat drought will have the undesirable side effect of eutrophication, unless this water is subjected to tertiary treatment (which, at present, is a costly procedure).

The third cause of water pollution has already had a profound impact on the ecology of the Everglades. Studies have been made to determine the amount of contamination from pesticides such as DDT, DDD and DDE in the natural environment of the Everglades. In parts per billion, the findings are:

Fresh and estuarine water	0.02
Rainfall	0.08
Marsh Soil	40.00
Algal mat	200.00
Small fish	500.00
Bald eagle	8,000.00
Brown pelican	8,000.00

-- Harte, John and Socolow, Robert H., Patient Earth, Holt, Rinehart and Winston, Inc., New York, 1971. pp. 189-192

STUDENT COMMENT NO. 29: Rainfall Factors for South Florida

The following data is compiled from Average Rainfall of the major cities in South Florida. Also included in the averages are data from rain gauges located in the heart of the Everglades.

DATE	AVERAGE RAINFALL (Inches)	DATE	AVERAGE RAINFALL (Inches)
1940	64.3	1953	69.9
1941	66.2	1954	67.9
1942	61.7	1955	44.9
1943	51.9	1956	40.5
1944	45.2	1957	68.8
1945	52.6	1958	66.4
1946	58.0	1959	81.2
1947	90.0	1960	68.7
1948	65.7	1961	41.5
1949	61.1	1962	51.6
1950	52.5	1963	52.4
1951	48.5	1964	60.7
1952	53.3	1965	55.0

Data from: Hydrologic Effects of Water Control and Management of Southwestern Florida, U.S. Geological Survey, 1972.

STUDENT COMMENT NO. 30: Water Use in South Florida

	YEAR	AVERAGE MILLIONS OF GALLONS PER DAY
Miami	1960	96.8
	1965	131.1
	1970	153.1
Fort Lauderdale	1960	20.0
	1965	28.6
	1970	40.7
West Palm Beach	1960	11.7
	1965	13.9
	1970	17.0
Total of all three	1960	128.5
	1965	173.5
	1970	210.8

1.18

Source: Hydrologic Effects of Water Control and Management in Southeastern Florida, US Geological Survey, 1972.

STUDENT COMMENT NO. 31: "Water Control in Southern Florida"

The hydrology (water system) of southern Florida is a complex, delicately balanced regime which has undergone almost continuous changes since man first began heavy settlement of the area in the late 1800's.

The northern section of the Everglades, just south of Lake Okeechobee, was covered with a thick layer of peat which sustained a heavy growth of vegetation, especially sawgrass. During wet periods, water *covered the entire surface, filtering slowly* -- almost imperceptibly, overland through the dense vegetation. Much water evaporated. In the southern part of the Everglades, where the limestone bedrock protrudes in many places and the plant life is less dense, the overland flow of water is more rapid. Most of the water in the Everglades comes either from this southward filtering process or from rain falling directly upon the region.

Before any land was drained and reclaimed in the northern portion of the Everglades, during high water the water levels in Lake Okeechobee and those in the adjacent Everglades were probably identical. When water stages reached 15 feet, overflow from the lake probably took place first at two low places -- the Caloosahatchee River to the west, and a low-lying, narrow reach into the Everglades to the south. When water stages climbed to 18 feet, water overflowed in one flat, broad slough along the entire southern shore, moving into the sawgrass swamp and southward toward tidewater.

That was before man made any appreciable impact on the hydrological environment in the area. Modification of the watershed began as early as 1882, with the construction of drainage canals and levees around Lake Okeechobee. By 1883, a shallow canal linked the Caloosahatchee River to Lake Okeechobee. In 1905, man began to drain portions of the Everglades in order to reclaim the rich peat surface as fertile farmland. By 1921, four major canals had been dredged to connect the lake with the Atlantic Ocean. The eastern outlets were at Miami, Fort Lauderdale, Deerfield Beach and West Palm Beach. Hurricane gates were installed at the lake ends of these canals to prevent tidal overflow from hurricanes from inundating

low-lying farmlands, and to contain Lake Okeechobee when its water level exceeded that of the adjacent drainage canals. In 1924, the St. Lucie Canal was completed (meeting the Atlantic at Stuart). This waterway became the chief controlled outlet from Lake Okeechobee from 1935-1946. The devastation inflicted upon the southern shore of the lake by two severe hurricanes (See Student Comment No. 25 "Nature Strikes Back," p. 80) led to the construction of a new and much higher earthen dike along the east, south and west sides of the lake. Completed in 1938, the new levee was 85 miles long and from 34-38 feet high, several times the height of the former dike which had proven so insubstantial against the fury of the storm-lashed lake.

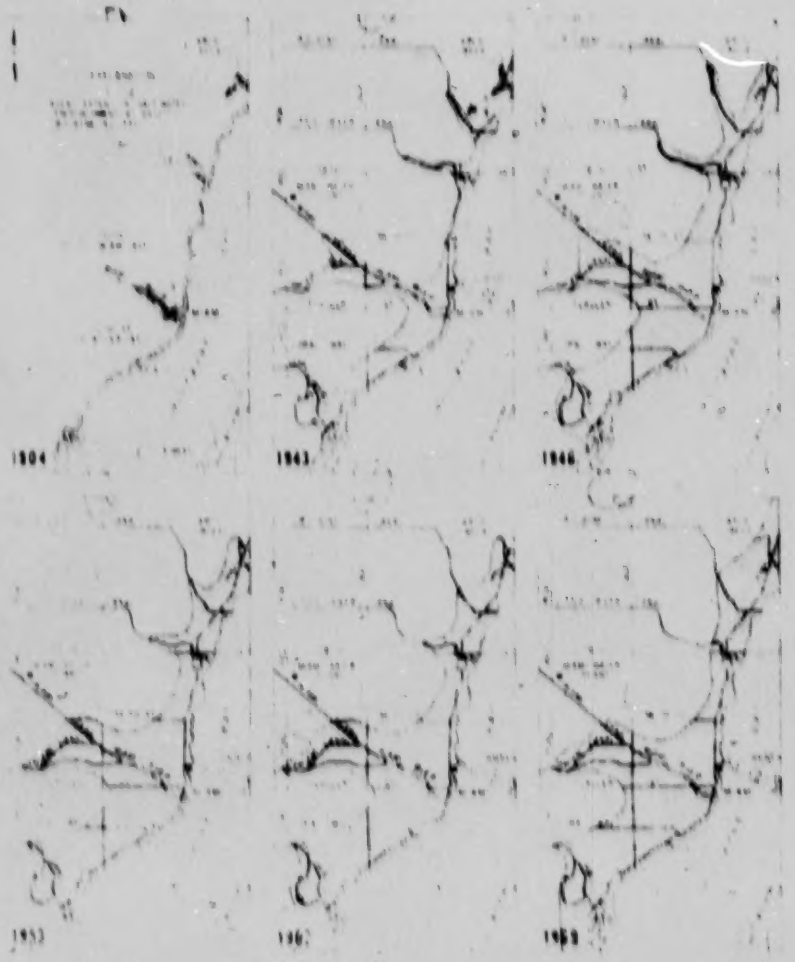
FLOOD CONTROL SYSTEM INSTALLED

As more and more land south and east of Lake Okeechobee was reclaimed for agriculture, increasingly larger areas came under the flood control program. Drainage was thorough, and a large part of the overland flow in the Everglades was diverted through the canal system to the ocean. Most of the network of drainage canals had been completed by 1932.

1.0

Problems arose during periods in the 1930's and 1940's when uncontrolled or inadequately controlled drainage poured too much precious fresh water into the Atlantic. The result was a damaging intrusion of salt water into the Biscayne area water table (see maps on following page). After the drought in 1943-1945, the larger canals were equipped with control devices which could discharge fresh water during the rainy season and retain it during dry spells to resist the encroachment of saline water. However, further weaknesses in the system were revealed when the heavy rains of 1947 caused widespread flooding in urban and agricultural areas of southeast Florida. This led to the establishment in 1949 of the Central and South Florida Flood Control District, which was designed both to control flooding during wet periods and to conserve fresh water for periods of drought. Working in collaboration with the Army Corps of Engineers, the

FCD was developed during the 1920's. Water conservation areas #1 and #2 were enclosed by levees in Palm Beach and Broward Counties.



Maps of the Miami area in eastern Dade County showing the sea-water encroachment at the base of the Biscayne aquifer 1904-69 (Parker, Ferguson, Love, and others, 1955, p. 589, Kohout, 1961, Leach and Grantham, 1966) updated

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-- Hampton, E.R., Klein, Howard, and Leach, S.S., U.S. Geological Survey, Hydrologic Effects of Water Control and Management of Southeastern Florida, Tallahassee, Fla., 1972, "History of Water Control Works," pp. 21-23.

STUDENT COMMENT NO. 32: Everglades Rainfall Readings (in inches) for 1948 - 1971
(Taken at 40 Mile Bend raingauge station near Tamiami Trail)

YEAR	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	YEAR TOTAL
1948	1.48	0.70	0.05	3.67	2.61	1.67	5.84	11.95	19.30	10.59	0.20	0.41	58.47
1949	0.12	1.30	0.23	3.45	5.15	10.83	15.09	9.25	14.12	6.61	0.79	2.32	69.26
1950	0.04	0.75	2.32	3.75	4.12	4.90	8.06	9.99	9.59	8.89	1.10	2.45	56.96
1951	1.15	1.62	0.89	4.53	1.93	1.99	8.70	6.92	3.16	6.23	0.67	0.60	38.39
1952	1.59	2.77	1.97	1.17	7.60	8.70	e 9.74	6.30	7.45	8.80	0.40	0.05	56.34
1953	3.17	2.00	2.62	e 5.55	3.17	7.54	9.57	7.66	e 15.57	4.72	0.68	1.24	63.49
1954	0.23	1.48	2.78	3.84	6.67	8.74	7.24	5.21	10.16	0.98	1.98	0.68	49.99
1955	0.73	0.44	0.45	2.44	6.89	9.72	6.58	3.32	10.40	2.32	1.25	1.54	46.13
1956	1.34	0.58	0.87	3.21	1.36	6.16	6.98	7.78	6.61	7.73	0.19	0.16	42.97
1957	0.37	4.05	1.91	4.60	6.53	7.48	10.26	e 12.33	11.51	6.86	0.34	1.98	e 68.22
1958	6.11	1.18	5.55	0.58	11.72	11.53	7.49	4.02	3.29	4.59	0.34	2.93	59.33
1959	2.04	0.32	5.57	1.64	10.84	12.88	6.29	7.54	8.61	6.23	6.58	0.64	67.18
1960	0.07	2.19	1.19	6.98	3.29	8.86	12.66	9.89	19.05	7.23	1.91	0.59	73.91
1961	1.34	e 0.98	0.98	0.50	7.05	7.65	6.10	9.37	4.76	4.68	0.55	0.09	e 44.05
1962	1.46	0.50	3.65	0.73	6.36	18.78	4.87	3.80	10.91	3.27	1.34	0.39	56.06
1963	0.61	3.78	1.52	0.66	8.29	5.54	8.49	11.22	12.35	4.02	2.67	3.26	62.41
1964	1.00	1.54	2.03	4.36	4.37	10.36	3.79	10.50	9.13	6.48	0.79	0.93	55.29
1965	1.42	2.71	1.33	1.98	2.36	7.24	7.55	7.78	8.60	5.52	2.38	0.62	49.49
1966	4.53	1.35	0.76	2.84	6.97	13.15	8.00	7.23	10.04	5.34	0.50	0.75	61.46
1967	1.88	1.17	2.81	0.10	2.76	14.06	5.86	5.22	8.34	7.69	2.16	1.47	53.52
1968	1.22	1.76	1.59	0.55	16.69	14.11	5.22	8.11	6.81	8.97	1.78	0.03	66.84
1969	3.15	1.88	2.05	3.49	4.01	23.48	6.34	5.58	11.51	11.75	0.54	1.33	75.11
1970	2.85	1.68	e 7.80	e T	5.39	8.37	3.29	3.73	4.23	9.93	0	0.19	e 47.46
1971	0.78	0.80	0.41	0	3.18	6.81	3.70	7.93	6.54	5.68	0.89	1.70	38.42

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STUDENT COMMENT NO. 33: Everglades Water Discharge Readings for 1963 - 1973

(Taken at water control gates 5-12)

CALENDAR YEAR	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	YEAR TOTAL
1963	0	0	0	0	0	0	0	0	0	0	0	0	* 0
1964	0	0	0	56	811	2,530	1,570	0	0	0	0	0	4,970
1965	2,260	0	0	93	0	0	0	728	3,460	5,720	21,700	2,980	36,940
1966	1,320	5,780	43,490	41,750	42,360	67,770	200,300	242,500	165,600	159,900	35,690	0	1,006,000
1967	9,130	7,760	16,310	10,640	6,380	7,750	17,720	33,440	29,520	18,490	16,380	7,860	181,000
1968	9,350	7,630	6,240	4,830	5,430	91,520	248,000	269,100	179,700	113,500	59,330	16,370	1,011,000
1969	15,850	26,620	85,450	91,850	97,230	178,400	214,000	197,400	182,400	193,510	269,060	218,120	1,769,800
1970	121,[illegible]	152,250	182,980	18[illegible]	67,150	138,270	124,380	67,640	24,530	68,880	56,010	39,800	1,232,500
1971	22,[illegible]	9,[illegible]	4,160	1,5[illegible]	2,6[illegible]	2,2[illegible]	7,505	11,450	31,900	54,500	58,450	36,460	240,000
1972	23,180	10,160	3,950	1,280	10,800	33,380	30,650	14,500	38,470	55,150	48,080	36,320	309,550

U. S. Geological Survey

STUDENT COMMENT NO. 34: Everglades Water Level Readings (in feet) for the Year Ending September 1963

(Taken at Everglades P-33 water level gauge)

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	6.17	5.82	5.73	5.50	5.27	5.12	4.06	a 3.50	4.27	5.25	5.41	5.71
2	6.15	5.81	5.72	5.49	5.26	5.21	4.06	a 3.40	4.21	5.22	5.39	5.74
3	6.12	5.83	5.72	5.48	5.24	5.19	4.02	a 3.40	4.56	5.19	5.40	5.72
4	6.11	5.81	5.71	5.47	5.27	5.16	4.00	a 3.40	5.17	5.20	5.43	5.70
5	6.10	5.80	5.70	5.46	5.27	5.14	a 4.00	a 3.40	5.34	5.25	5.42	5.69
6	6.08	5.79	5.70	5.46	5.25	5.11	a 3.90	a 3.40	5.24	5.23	5.41	5.67
7	6.05	5.78	5.69	5.45	5.23	5.08	a 3.90	a 3.30	5.32	5.21	5.39	5.65
8	6.02	5.77	5.68	5.46	5.21	5.04	a 3.90	a 3.30	5.20	5.21	5.37	5.64
9	6.00	5.67	5.68	5.46	5.19	5.02	a 3.90	a 3.30	5.28	5.17	5.35	5.64
10	5.98	5.90	5.67	5.45	5.17	5.00	a 3.90	a 3.30	5.27	5.13	5.33	5.63
11	5.96	5.85	5.66	5.44	5.15	4.97	a 3.90	a 3.20	5.26	5.17	5.31	5.63
12	5.94	5.88	5.65	5.44	5.21	4.93	a 3.80	a 3.20	5.25	5.30	5.28	5.61
13	5.94	5.87	5.63	5.43	5.25	4.89	a 3.80	a 3.20	5.30	5.37	5.32	5.59
14	5.94	5.86	5.62	5.42	5.22	4.86	a 3.80	a 3.10	5.28	5.38	5.36	5.57
15	5.92	5.85	5.62	5.42	5.20	4.82	a 3.80	a 3.10	5.27	5.39	5.34	5.57
16	5.89	5.85	5.61	5.41	5.27	4.78	a 3.80	a 3.00	5.26	5.38	5.36	5.57
17	5.87	5.84	5.60	5.41	5.34	4.74	a 3.70	2.89	5.24	5.38	5.45	5.55
18	5.86	5.84	5.60	5.40	5.33	4.70	a 3.70	2.81	5.20	5.37	5.53	5.55
19	5.84	5.83	5.59	5.39	5.33	4.65	a 3.70	2.71	5.17	5.35	5.64	5.56
20	5.82	5.83	5.59	5.38	5.32	4.60	a 3.70	2.62	5.12	5.34	5.73	5.66
21	5.81	5.82	5.58	5.38	5.30	4.53	a 3.70	2.54	5.09	5.31	5.79	5.73
22	5.79	5.81	5.56	5.37	5.29	4.46	a 3.60	2.48	5.05	5.29	5.78	5.77
23	5.78	5.80	5.57	5.36	5.27	4.41	a 3.60	2.43	5.07	5.27	5.78	5.87
24	5.78	5.78	5.56	5.35	5.27	4.36	a 3.60	2.39	5.12	5.24	5.80	6.01
25	5.76	5.78	5.56	5.34	5.26	4.32	a 3.60	2.38	5.11	5.21	5.78	6.28
26	5.74	5.77	5.55	5.34	5.26	4.27	a 3.60	2.34	5.12	5.22	5.76	6.30
27	5.73	5.75	5.54	5.33	5.26	4.23	a 3.50	2.30	5.19	5.18	5.76	6.28
28	5.71	5.74	5.53	5.32	5.24	4.19	a 3.50	2.25	5.30	5.15	5.73	6.27
29	5.70	5.74	5.53	5.31		4.14	a 3.50	2.68	5.29	5.28	5.70	6.23
30	5.72	5.73	5.52	5.29		4.10	a 3.50	4.38	5.28	5.48	5.67	6.19
31	5.64		5.51	5.28		4.07		4.33		5.45	5.67	

STUDENT COMMENT NO. 35: Everglades Water Level Readings (in feet) for the Year Ending September 1967

(Taken at Everglades P-33 water level gauge)

DAY	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.
1	6.49	6.05	6.27	5.86	5.74	5.69	5.66	6.71	5.32	5.80	5.75	5.95
2	6.48	6.01	6.25	5.85	5.73	5.64	5.65	6.66	5.31	5.86	5.74	5.94
3	6.46	6.00	6.22	5.84	5.72	5.61	5.65	6.61	5.31	5.87	5.74	5.93
4	6.45	5.98	6.20	5.83	5.72	5.61	5.65	6.56	5.33	5.90	5.75	5.97
5	6.47	6.17	6.19	5.81	5.71	5.63	5.64	6.51	5.35	5.88	5.77	5.97
6	6.89	6.15	6.17	5.80	5.71	5.62	5.64	6.47	5.44	5.89	5.81	5.97
7	6.90	6.15	6.16	5.79	5.70	5.61	5.63	6.43	5.46	5.92	5.84	5.99
8	6.90	6.15	6.14	5.78	5.72	5.61	5.62	6.39	5.47	5.90	5.86	5.98
9	6.90	6.14	6.13	5.77	5.78	5.60	5.61	6.34	5.46	5.87	5.87	5.96
10	6.91	6.13	6.11	5.76	5.78	5.69	5.60	6.28	5.46	5.89	5.84	5.96
11	6.91	6.11	6.09	5.75	5.77	5.64	5.60	6.23	5.46	5.82	5.92	5.93
12	6.88	6.10	6.09	5.74	5.76	5.61	5.58	6.18	5.54	5.79	5.86	5.94
13	6.86	6.09	6.08	5.73	5.81	5.62	5.57	6.13	5.61	5.77	5.90	5.96
14	6.85	6.07	6.06	5.73	5.79	5.61	5.56	6.08	5.75	5.75	5.98	5.95
15	6.83	6.04	6.05	5.73	5.78	5.60	5.55	6.02	5.73	5.73	5.99	5.93
16	6.81	6.01	6.03	5.80	5.77	5.59	5.53	5.98	5.77	5.71	5.98	5.92
17	6.80	5.59	6.02	5.78	5.76	5.57	5.51	6.21	5.90	5.70	5.97	6.07
18	6.74	5.57	6.01	5.77	5.75	5.57	5.29	6.68	5.91	5.68	5.97	6.05
19	6.78	6.55	6.00	5.77	5.74	5.55	6.27	6.61	5.93	5.67	5.96	6.04
20	6.76	6.51	5.98	5.77	5.73	5.54	5.24	6.54	5.96	5.65	5.95	6.32
21	6.79	6.50	5.97	5.76	5.72	5.53	5.20	6.49	5.92	5.64	5.94	6.02
22	7.05	6.48	5.96	5.80	5.72	5.52	5.17	6.44	5.88	5.62	5.95	6.00
23	7.10	6.45	5.95	5.79	5.71	5.49	5.14	6.86	5.84	5.62	5.94	5.99
24	7.06	6.42	5.94	5.80	5.70	5.49	5.10	6.88	5.81	5.65	5.91	6.00
25	7.02	6.40	5.92	5.80	5.69	5.48	5.06	6.82	5.84	5.69	5.92	6.01
26	6.99	6.38	5.91	5.79	5.67	5.46	5.03	6.77	5.81	5.75	5.95	6.01
27	6.95	6.35	5.90	5.78	5.66	5.45	4.98	6.72	5.80	5.84	5.98	6.04
28	6.93	6.33	5.89	5.78	5.66	5.42	4.93	6.61	5.77	5.79	5.98	6.06
29	6.90	6.31	5.88	5.76	-----	5.44	4.86	6.08	5.77	5.77	5.96	6.10
30	6.84	6.29	5.87	5.75	-----	5.43	4.77	6.05	5.79	5.73	5.93	6.13
31	6.86	-----	5.86	5.74	-----	5.46	-----	6.14	-----	5.75	5.96	-----
Max	7.10	6.83	6.27	5.86	5.81	5.66	5.46	6.14	5.96	5.92	5.99	6.13
Min	6.76	6.29	5.86	5.73	5.66	5.42	4.77	5.98	5.32	5.62	5.74	5.91

U. S. Geological Survey

STUDENT COMMENT NO. 36: Water Control Data Chart

Year[1]	Rainfall[2] (Yearly total in inches)	Water Discharge[3] (yearly total in acre-feet)*	Gauge (water) Height[4] (Readings in feet)	
			Lowest	Highest

* 1 acre-foot = 43,560 cubic feet

[1] Data for columns 1 and 2 given in calendar year while other columns given in water year.

[2] Readings taken at 40 Mile Bend Rain-gauge Station.

[3] Readings taken at Flood Control Water Gates.

[4] Readings taken at Everglades P-33 water level gauge.

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STUDENT COMMENT NO. 37: Alligators: Dragons in Distress

All animals to some degree affect the landscape they live in. The alligator does so to a greater extent than most. Its habit of controlling its environment is part of the special resilience which has allowed the species to live through the ages. To an alligator, home is a nest, a "gator hole" or pool, a cavelike den and a system of trails.

Individual alligators live a long time in one place, and because some dens pass from one generation to the next, the effect on the marsh topography can be considerable. Some gator holes come to be flanked by spoil banks of material dredged from the pool or excavated from the den. On these piles, plants different from those of the surrounding area take root. Little islands with sedges, grasses and even trees often stand beside old gator holes. These islands have been made by the alligator and its ancestors by heaping up of nest piles and dredging of the den pool with mouth and tail. These islands also provide well drained material in which other species can nest (e.g. turtles and birds).

In much of the territory alligators live in, the normal regimen is an alternation of wet times and dry times. During the droughts, the alligator holes may keep the fauna from being wiped out completely. When a marsh goes suddenly dry, most of the fish, amphibians, turtles, and invertebrates suffocate in the hot mud. But each time, some are saved in the water-filled alligator holes. The holes create reservoirs where fish take refuge. Birds, deer, raccoons, and other reptiles seek gator holes to slake their thirst. Enough escape being eaten by the gators to repropagate their species when high water returns.

An alligator in a pond is an influential member of the pond community. His droppings fertilize the water and contribute to its productivity. His comings and goings open channels in the vegetation and slow the processes by which the pond gives way to marsh. By feeding on the gar fish, the alligator also aids nature's balance while it satisfies its own healthy appetite. The bony-scaled (gar) fish fears few other enemies. Without a check on their numbers, schools of spotted gars would eat the Everglades clean of bass and bream.

National Geographic, January 1967
"Alligators: Dragons in Distress",
Archie Carr

STUDENT COMMENT NO. 38: Let's Save the Alligator!

With his awesome jaws, sledgehammer tail and portable armor, the American alligator has survived for 120 million years or so. At one time, perhaps 30 million of these powerful creatures basked in the sun of our southern states. One early explorer saw alligators on a Florida river "in such incredible numbers it would have been easy to walk across on their heads, had the animals been harmless."

The American alligator is in trouble. Because of man's depredations over the last century, the alligator population has been reduced to remnants found mostly in Georgia's Okefenokee Swamp, in Louisiana bayous, and in Florida marshlands. Even these are going, at an appalling rate. Last year, poachers -- who illegally hunt alligators for their skins -- killed about 40,000 in Florida alone. "We now count the alligator as a seriously endangered species," says Herbert M. Mills, executive director of the World Wildlife Fund.

It's hard to work up much love for a creature usually pictured as doing little but waiting for someone to fall into the water. But the fact is that alligators are not usually belligerent toward man except when molested. Furthermore, alligators do a lot of good in the swamp. As the water level drops druing the yearly dry period, each digs his gator hole deeper and deeper until it often is the only spot around still holding water. Bobcats and raccoons use it as a watering place. Fish, turtles and frogs swim in it. Birds nest in the surrounding foliage. Without it, a lot of other wildlife would die.

To see for myself what is happening to the gator, I recently spent a few weeks in the Everglades, the giant swamp occupying most of southern Florida. One night, just as twilight urged the sun below the far horizon, I went on a tour of the glades with Lt. Tom Shirley, law enforcement supervisor for the Florida Game and Fresh Water Fish Commission.

The wind had died, and the air was wet and heavy with the sensuous smell of breathing vegetation. The sawgrass, stretching prairie-like to infinity, stood smooth and motionless, broken only by hammocks of

scrub willows and redbay. We launched our airboat -- an airplane-propeller-driven skiff hauled behind Tom's car on a trailer -- onto a black canal some 20 miles west of Miami. Tom strapped a spotlight to his forehead and we climbed to an open seat six feet above the boat deck. Then he started the huge prop behind us, and we roared away down a tunnel of blackness.

Expertly he weaved along the waterway, flashing his light back and forth, picking a safe path with uncanny skill. Ahead, snakes swam from our path, turtles ducked in panic, and bullfrogs floated like pale blobs.

Suddenly Tom raised his arm and pointed. Two hundred feet ahead two small ruby-red lights glinted--the reflecting eyes of a yard-long alligator floating in the water. Tom cut the motor and we coasted. As we approached, it slapped its tail and ducked under a glass clump.

A little later Tom spotted another, this one only about ten inches long. He reached over and scooped him up and the gator, amazed, opened his mouth and hissed like a turtle. Tom handed him to me, then directed his lamplight into the reptile's mouth to reveal the flap of skin that seals the throat so that he can submerge with his mouth open. The animal's eyes, I saw, were equipped with transparent lids to enable him to see underwater; his nostrils were like little snorkels.

The alligator bent double, then straightened, and the strong little tail slapped my wrist smartly. It stung. An adult alligator can break a man's leg with his tail.

I returned the baby to the water, and he sank to the bottom, deathstill. He was slowing down his heart, I knew, preparing for a long submergence. Experiments show that adult alligators can hold their breath underwater for two hours at a time by slowing their heartbeat.

"Now," said Tom, "I want to show you a gator hole." We cruised to the edge of an island of willows and buttonbush. Inside was a pond 20 feet across, abandoned now, and filling with aquatic weeds and silt.

An alligator forms his hole with care. First he scoops out a depression in the mud with his snout, then tears out the vegetation and roots with his teeth and forefeet, and with his tail slaps this material together to form a doughnut-like mound around the pool. Then he digs a horizontal tunnel, a den, in the side. Later,

trees take root in the levee, and eventually a dense hammock or island is formed. Since these ponds are often passed on from generation to generation of alligators, some may be thousands of years old.

A large hole may house as many as ten gators. During the spring mating season, a bull may leave his hole and roam several square miles, visiting and mating with various females. At this time he's producing one of the grandest sounds in nature -- a deep, booming bellow unlike any other sound in the wild -- to warn other bulls and to let the cows know that he's on the way.

About three weeks after mating, the female begins to build her nest, a task that can take as long as a week. She gathers sticks, grass and mud in her toothy mouth, and builds a mound the size of a dining-room table. Then she squirms around on top, digging with her hind legs until a hollow forms, in which she lays 20 to 60 eggs. She shoves mud and grass over them, smooths the top, then eases herself into the water, exhausted. The nest material acts as an incubator, keeping the eggs at temperatures ranging from about 80 to 100 degrees F.

She guards her nest for about two months, wetting it during hot, dry days, repairing the top when rains threaten to wash the mud away. When the eight-inch young gators hatch, they call with high-pitched oinks for mother. She scrapes and bites away the half foot of sod on top, freeing them; then everyone splashes off for a swim. In some areas, snails and crawfish makr up a large part of the baby alligator's diet. A mature alligator will devour nearly anything that moves -- garfish, snakes, armadillos, even dogs.

The female alligator is one of the few reptiles to show a tender concern for her offspring. For the first year or two, the young hang around home. Then, when two feet to a yard long, they set off on their own. They'll continue to grow a foot or more a year, then slow down at six, the breeding age. Mature females stretch to about eight feet, males to ten feet or more. At one time, 15-foot giants were not rare.

At our gator hole, Tom sniffed the air. "Something's rotting around here," he said. In the brush we found three dead alligators, three to five feet long, their belly sections stripped away. "Poachers," said Tom, sadly. "They take only the belly skin; the rest is too tough."

Everglades poachers are tightly organized and their equipment rivals that of the police: swift airboats, giant halftracks, jeeps and trail motorcycles, two-way radios and even planes. There are fewer than 25 law-enforcement officers to cover more than a million acres. In order for a poaching arrest to stick, a violator must be caught with an alligator skin in his possession -- difficult to do, because when apprehended in the swamp, he simply throws the rolled up skin overboard and it sinks from sight, usually forever.

The next night I went up with Tom in a spotter plane. A dozen times in the wilderness 1000 feet below us lights appeared. Most were the steady, yellowish lamps of fishermen, but suddenly we caught sight of a flash and a sweep from a powerful beam -- on for a few seconds, then off. "That could be a poacher," said Tom. He radioed one of the patrol cars waiting below, lights off, with a trailered airboat. "Clem, where are you? Okay. Check out a light three miles south of the Trail, toward the dike." Eventually the officer reported back: if it was a poacher, he had evidently quit for the night.

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Later that night I transferred to a patrol car on the ground. When the plane spotted a suspicious light in our area, we were soon roaring down the meandering waterways in our airboat. The sound was deafening, but anyone in another airboat couldn't hear us approach unless he had stopped.

We came to a clearing and there was another airboat -- stopped, and silent. The two rough-hewn men, with a touch of wary defiance, insisted they were frogging. The officer with me looked the boat over. He found no guns or hides -- or frogs.

A few days later, I had an opportunity to talk with a poacher, "Big Jack," who has been gator hunting for seven years. A $6000-a-year laborer by day, he hunts only during the dry months -- March to June -- about four nights a week at it. The current market price for a hide is $5 to $6.50 a foot, and rising. Most hides find their way to processors in the New York or Chicago area, who pay about $20 a foot. (Men's alligator shoes retail for $70, a prime alligator suitcase for as much as $1000.)

Big Jack drove me around the glades while we talked. His basic technique, I learned, is to run an airboat along a canal until he spots a pair of alligator eyes, then shoot between them with a .22. "This stuns

him," he said. "Then I gig him with a pipe that has two shark hooks brazed to it, haul him in, and whack him behind the head with a machete. I can skin "em in about three minutes -- no trouble at all, unless he's come to."

He slats the skins, then leaves them a secret place out in the swamp, rolled up in five-gallon oil cans. "The most dangerous part is taking the skins out. I bring out a batch every three months when the dealer comes through. It's true, though, pretty soon there ain't going to be any gators left."

I asked him if he worried about getting caught. He laughed. Though penalties allow for $1000 and a year in jail, Florida judges are lenient. Those poachers not let off entirely have in recent years been fined, on the average, only $79. More realiztic penalties would help prevent alligators from sliding into oblivion. So would legislation making it a federal offense to transport illegal skins across state lines.

But the most important potential weapon is economic: take the profit out of it by boycotting alligator-skin goods. Almost all genuine alligator shoes, handbags and suitcases sold are made from hides that come from illegal sources. As one conservationist puts it, "People should be embarrassed to wear alligator items, and stores should be ashamed to sell them." What's needed is a campaign similar to the one that 60 years ago saved the beautiful egret. Women then were paying high prices for egret plumes. But, largely because of the efforts of Audubon societies, they became aware that they were helping to kill the egret. Plumes went out of style, federal legislation was passed, the egret was saved from extinction.

Surely the alligator deserves as much.

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"Let's Save the Alligator!" Readers Digest, December, 1969.

STUDENT COMMENT NO. 39: Rare and Endangered Fish and Wildlife of the United States

BIRDS

Rare and Endangered Birds

Florida Great White Heron
Florida Everglade Kite (Florida Snail Kite)
Short-tailed Hawk
Southern Bald Eagle
American Peregrine Falcon
Florida Sandhill Crane
Cape Sable Sparrow

Peripheral Birds

Eastern Reddish Egret
Wood Ibis
Roseate Spoonbill
Atlantic Sooty Tern
Atlantic Noddy Tern
Florida Mangrove Cuckoo
West Indian Nighthawk
Cuban Black-whiskered Vireo
Cuban Yellow Warbler

Status - Undetermined Birds

American Osprey

MAMMALS

Rare and Endangered Mammals

Florida Panther
Florida Manatee or Florida Sea Cow

Status - Undetermined Mammals

Florida Water Rat or Round-tailed Muskrat
Everglades Mink

REPTILES AND AMPHIBIANS

Rare and Endangered Reptiles

American Alligator

Peripheral Reptiles

American Crocodile
Green Turtle

STUDENT COMMENT NO. 40: Species of the Everglades

BIRDS (163 Species - some listed below)

Roseate Spoonbill
Anhinga or Water Turkey
Purple Galinule
Coot
Everglades Kite
Bald Eagle
Marsh Hawk
Limpkin
American Egret
Snowy Egret
Sand Hill Crane
Pelicans (2)
Cormorant
White Ibis
Blue Heron
Louisiana Heron
Common Egret
Frigate Bird
Red Shouldered Hawk
Stilt
Swallow-tailed Kite
Boat-tailed Grackle
Pileated Woodpecker
Wood Stork
Vultures
Osprey
Barred Owl
Great White Heron
Little Blue Heron
Wood Ibis
Least Sandpiper
Sooty Terns
Ruddy Turnstone
Great Blue Heron
Glossy Ibis

MAMMALS (13 species - some listed below)

Cougar or Panther
Bobcat
Raccoon
White-tailed Deer
Mangrove Squirrel
Marsh Rabbit
Round-tailed Muskrat
Opossum
Otter
Cotton Rat
Red Fox
Sea Cow or Manatee

REPTILES (42 species - some listed below)

Green Snake
Everglades Racer
Indigo
Everglades Rat Snake
Everglades Swamp Snake
Banded Water Snake
Water Moccasin
Eastern Diamondback
Pigmy Rattler
Turtles (several)
Lizards (several)
Alligators
Green Turtle

FISH FOOD CROP FOR WADING BIRDS
(7 most important)

Least Killifish
Mosquito fish (Gambusia)
Blue-fin Killifish
Flag Fish
Golden Topminnow
Pigmy Sunfish
Blue Spotted Sunfish

OTHERS

Frogs (many)
Siren
Mosquito Fish
Longnose Gar
Tarpon
Snook
Black Bass
Mangrove Snapper
Numerous Insects (most prominent mosquitoes of a tremendous variety)
Shrimp
Crayfish
Florida Gar
Large Mouth Bass
Bluegill
Spotted Sunfish
Crappie
Channel Catfish

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STUDENT COMMENT NO. 41: Jetport Controversy - A Simulation

SITUATION:

An open public hearing is taking place before an "Intergovernmental Review Team" for the purpose of hearing arguments for and against the construction of a Jetport in the Everglades.

ROLES:

Students will play the following roles:

A. Members of Review Team - a representative from each of these:
   1. The Governor of Florida
   2. The Federal Aviation Administration
   3. The Board of County Commissioners of Dade County, Fla.
   4. The Secretary of Transportation
   5. The Secretary of Interior

B. Pro-Jetport Witnesses
   1. Wildlife Biologist (witness on the effect it would have on the biotic communities/wildlife)
   2. Engineer (witness on the effect it would have on the land surface)
   3. Environmental Engineer (witness on the effect it would have on air quality)
   4. Environmental Engineer (witness on the effect it will have on water resources)
   5. Sanitation Engineer (witness on the matter of disposal of solid waste)
   6. Engineer (witness on the displacement of people which might be a result of the Jetport)
   7. Representative of U. S. Department of Transportation (witness on noise impact)

8. Doctor from Dade County Health Department (witness on public health impact)
9. Engineer (witness on flood control)
10. Representative of the U. S. Department of Interior (witness on historical value)
11. Economist (witness on economic impact)
12. Engineer (witness on construction and impact of highways)
13. Representative of the Federal Aviation Administration (witness on aviation needs today and in the future)

C. Anti-Jetport Witnesses

1. An Environmental lawyer representing the "Friends of the Everglades".
2. Anyone from the general public who wished to speak in opposition to the jetport.

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PROCEDURES:

The chairman of the review team will call the hearing to order and explain the purpose of the hearing. He will then call for witnesses who wish to present arguments for the construction of the Jetport. He will then call for witnesses who wish to present arguments against the Jetport. After all formal witnesses have been heard, the chairman will invite discussion and questions from the general audience. After all discussion is completed, the Review Team will vote on whether to proceed with the building of the Jetport. Once the vote is completed and announced, the meeting will be adjourned.

STUDENT COMMENT NO. 42: "Selection of Location for the South Florida Regional Airport"

Extensive planning went into the selection of the site for the new South Florida Regional Airport. The original plan called for implementation of the project in four consecutive steps:

1. Approval of the site location for a new major airport in the South Florida area.
2. Acquisition of the proposed site.
3. Construction of a single training runway and taxiway on the proposed site.
4. Ultimate development for air carrier operations, if and when the need develops.

Thus far the first three stages have been completed. The fourth, for the time being at least, has not.

A comprehensive study was conducted as provided in the terms of the Everglades Jetport Pact signed January 16, 1970 by the Federal government, the State of Florida, and Dade County. In essence, the Pact directed Dade County to locate and acquire a suitable site for a new airport and develop sufficient facilities there to transfer its training facilities from the Dade-Collier airport west of Miami. Funding was to be provided from a state and federal level.

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The "battle plan" in the comprehensive study was to consider a relatively large number of sites at first, and then progressively reduce the number under consideration while increasing the depth of investigation. It was expected that this method would achieve the highest quality of planning from the funds and time provided. The plan called for a Review Team consisting of representatives from five agencies or offices: 1) the Governor of Florida, 2) the Federal Aviation Administration (FAA), 3) the Board of County Commissioners of Dade County, Florida, 4) the Secretary of Transportation and 5) the Secretary of the Interior.

The function of the Review Team was to approve and administer the conduct of the Study, decide as to the initial sites to be studied, decide at appropriate times during the study as to elimination of particular sites from further consideration, make the final decision as to the site to be recommended, and conduct

public hearings on the recommended site. To perform the detailed studies and draft the reports the Review Team needed to make its decisions, a large Study Team of 40 specialists was assembled. These experts drew up 72 reports providing in-depth analyses in the following 24 areas:

Ecology	Matrix Analysis
Public Health	Airport Design
Waste Disposal	Noise Forecasts
Airspace	Bonding
Airport Engineering	Economics
Urban Planning	Financial Feasibility
Highway Engineering	Noise Impact
Law	Institutional Considerations
Hydrology	Technology Forecasts
Demand Forecasts	South Florida Ecology
Mass Transit	Traffic Forecasts
Community Response	Architecture

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Input was also provided from the FAA, the Department of the Interior, and the Department of Transportation.

In addition to the extensive studies conducted, the airport planners sought maximal community participation. In the spirit of the Florida "Sunshine Law" which requires state or local officials to discuss public business only when their discussion is open to news media, the Review Team opened up all its meetings and records to the media, from the beginning to the end of the investigation. Media coverage was thorough. Another means of keeping the public informed was public hearings, timed to precede key Review Team decisions. At such hearings, the floor was opened to the public for statements and questions, both prepared and extemporaneous. At no point was information concealed, and every effort was made to make the office of the Study Coordinator (Norman W. Arnold of Howard, Needles, Tammen and Bergendoff) available to anyone seeking information. Every citizen's comment or complaint received a reply. Hundreds of meetings were held with scores of community organizations and many other agencies. In short, every effort was made to achieve as broad a base of public involvement as possible in the determination of a location for the South Florida Regional Airport.

Dade County Port Authority, South Florida Regional Airport Site Selection Study Program, Preliminary Environmental Impact Statement, Oct, 1972, "Introduction," pp. 7-9.

STUDENT COMMENT NO. 43: "Projected Impact of a South Florida Regional Airport"

> "The effects upon the South Florida ecosystem as a whole will be minimal. Little or no impact on populations or rare or endangered species will occur."

This statement, taken from the Dade County Port Authority's Preliminary Environmental Impact Statement on the proposed Everglades jetport, fairly well sums up the conclusions of the study in most areas relating to the environment. Although the statement acknowledges potential problems in some areas in general the evidence presented therein points favorably toward construction of the airport in a 31,000 acre tract of land west of Miami, at the eastern fringe of the Everglades. The report analyzed many different aspects of the potential environmental impact of the jetport. A summary of its findings follows:

Effect on Wildlife: Although most wildlife will flee the area during construction, adjacent land will provide alternative habitats. Reseeding will create new meadow-like biotic communities. Few species, if any, will be affected in the surrounding region.

Land Usage: About 9,000 acres will be cleared of 15-30 million cubic yards of peat. A third of the peat will be retained for landscaping. Much vegetation will be cleared. Excavation will create 1.2 square miles of open water. Erosion will occur only during actual construction.

Air Pollution: Air pollution will be limited to a 4-mile radius of the center of the runway system. Pollution from automobile exhaust will occur only within a few blocks of the terminal. Pollution from an on-site refuse incinerator will be insignificant. There will be no serious contamination of the region around the jetport.

Water Pollution: Only the water system within the airport site itself will be disrupted. Drainage to the Everglades will not suffer any substantial interruption. Advanced water treatment will keep waste water

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from the airport facilities at acceptable levels.

Solid Wastes: A high-performance incinerator like those used for municipal wastes will be adequate to handle airport refuse while complying with local regulations on air quality.

Displacement of Persons: Two private homes, 65 mobile homes, a public park, a fishing camp and two radio facilities will be affected. A local airport nearby will be closed to assure necessary airspace.

Land Development: Good zoning will be essential to control urban growth, since there will be much economic pressure for both commercial and residential development in areas surrounding the new airport.

Noise Pollution: The level of noise pollution will be low compared to that at existing airports in the Miami area, and confined mostly to the jetport site itself. Advanced technology will limit noise both in the aircraft and in a rapid transit system on the ground.

Public Health: The chief threat is disease-carrying insects from nearby swamps, but proper controls should minimize health hazards.

Flood Control: Since less than 30% of the 31,000 acre site will actually be affected by construction, substitute land from adjacent regions will be fully adequate to assure flood control.

Economics: Since development of the airport will stimulate the economy of the area, both the airport and airport access could probably be financed by revenue bonds.

Traffic: If existing plans for a highway system are implemented and new airport access routes constructed, the overall impact on traffic in the region will be minimal.

Effect on Other Airports: Operations at Miami International will be phased down to one runway by 1990; Opa Locka Airport closed entirely, and lesser restrictions imposed on air traffic at North Perry and Fort Lauderdale International Airports.

The study concluded by considering alternatives to the Everglades jetport, which was chosen from 36 sites originally investigated. Three major possibilities existed: 1) taking no action, and later developing

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Dade-Collier Airport, 2) taking limited action and continuing training operations at Dade-Collier, and 3) making adjustments in the design and boundaries of the Everglades facility.

-- Dade County Port Authority, South Florida Regional Airport Site Selection Study Program, Preliminary Environmental Impact Statement, Oct., 1972, "Summary," pp. 3-4.

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STUDENT COMMENT NO. 44: Population Growth and Air Travel

Population Growth in Selected Florida Counties

YEAR	DADE	BROWARD	PALM BEACH	TOTAL
1920	75,000	12,000	25,000	112,000
1930	150,000	35,000	50,000	235,000
1940	280,000	50,000	90,000	420,000
1950	500,000	100,000	125,000	725,000
1960	950,000	325,000	225,000	1,500,000
1970	1,225,000	600,000	325,000	2,150,000

-- US Geological Survey, 1972

Passenger Service - Miami International Airport

YEARS	MILLIONS OF PASSENGERS SERVED
1961-62	4.2
1962-63	4.4
1963-64	5.0
1964-65	5.9
1965-66	6.9
1966-67	8.4
1967-68	9.8
1968-69	10.5
1969-70	10.9
1970-71	11.8

-- 1971 Annual Report of the Dade County Port Authority

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STUDENT COMMENT NO. 45: Anti-Jetport

The state of Florida has been considering a "Big Cypress Swamp Jetport" which would jeopardize the the existence of much of the plant and animal life in the park. The intervening force this time has been Victor John Yannacone, Jr., a New York lawyer renowned as a defender of the environment. Yannacone filed a class action lawsuit on behalf of all those entitled to the full benefit, use, and enjoyment of the Everglades National Park, including not only this generation of American citizens, but generations unborn. He served a 58-page complaint against the promoters of the jetport. Co-defendants in the case were John A. Volpe, Secretary of Transportation of the United States of America and the Dade County, Florida Board of County Commissioners, Acting as Dade County Port Authority. One environmentalist lawyer against the combined forces of local, state and federal government -- hardly a match?

Or was it?

Yannacone's strategy was essentially the same as that of the Environmental Defense Fund in the Cross-Florida Barge Canal case, except that it placed even greater emphasis on a scientific study of the projected damages the jetport would cause to the environment. Yannacone's class action was also based on the alleged violation of the 5th, 9th and 14th amendments of all those who wished to enjoy the unspoiled natural resources of the Everglades.

Yannacone traced eight specific hazards to the environment which he claimed would be caused directly or indirectly by the construction of the "Big Cypress Swamp Jet Port":

1. Water pollution. The drainage and canalization of the area--essential to the construction of the airport--would radically alter the water system of the entire region and upset the balance of the Everglades ecosystem. Another form of water pollution is the possibility of eutrophication, a technical term for the widespread growth of algae which can be caused by the discharge of wastes

containing phosphates into natural waterways. Such wastes would inevitably accompany the large-scale construction projects required for the jetport.

2. Pesticide contamination. The quantities of DDT found in chemical analysis of the eggs of certain Everglades birds is already just under the danger level as a result of contamination from the present usage of the pesticide in Dade County. A new urban concentration around the proposed jetport would require extensive use of pesticides to control mosquitoes from nearby swamps. As a result, increased DDT contamination would most likely threaten numerous species of wildlife in the Everglades.

3. Air pollution. The fallout of jet exhaust during landings and take-offs would be certain to have an adverse effect on the presently pure atmosphere about the swamps, and would also be dissolved into the natural waterways below. Furthermore, there would be appreciable air pollution from exhaust fumes of the automobiles which could be expected to jam the new superhighways linking the jetport with the Metropolitan Miami area.

4. Danger of extinction for some species of wildlife. Numerous species of wildlife which are already on the list of rare and endangered species could be pushed into extinction by the spoilage of their natural breeding grounds. Among those threatened are 12 species of birds (Yannacone listed them), especially the extremely rare Cape Sable sparrow and the wood ibis; four species of mammals (the Mango fox, squirrel, manatee and Everglades mink), and the rare and endangered American Alligator. In addition, the area is known to contain 15 to 20 species of amphibians and 55 to 60 species of reptiles, all performing vital roles in the food-chain of the ecosystem. Rare tropical plants would also be threatened by side effects from the jetport, including species of tropical plants such as orchids and ferns which are found nowhere else in the United States.

5. Noise pollution. The constant noise along the jet corridor would disrupt the wilderness along

the northern part of the Everglades National Park and even more so in the Big Cypress Swamp to the north.

6. Disturbing Indian Tribes. The Miccosukee Indians would be suddenly subjected to 24-hour noise bombardment by powers utterly beyond their control.
7. Bird strikes. Large flocks of birds, especially large water birds, would pose a significant aviation hazard, from ground level to 2,000 feet. The presence of small animals on the runways during flood periods would aggravate the problem because they would be crushed by airplanes and attract carrion-eating birds.
8. Fire and smoke. The combination of bird strikes, pest insects from swamps and small animals seeking refuge from high water on the runways would doubtless prompt authorities to drain much of the jetport area, and property development around the jetport would cause other large expanses of land to be drained. This, in turn, would greatly increase the risk of fires and permanently destroy the ecological balance of the entire south Florida region.

Yannacone concluded by arguing that the negative effects of the jetport would be irreparable. Since no damages paid after the fact could restore the ecology of the region, the only alternative would be to prohibit its development.

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STUDENT COMMENT NO. 46: "Meanwhile, Back in the Glades. . ."

A few years ago there was a tremendous controversy over the planned development of a huge futuristic jetport west of Miami in the Everglades. Municipal authorities argued that a new facility was essential to take pressure off overcrowded airports in the Miami area. Conservationists contended that the heavy air traffic and side effects of fuel dumps, hotels, restaurants and highway traffic to and from the jetport would cause irreparable damage to the delicate ecology of this unique area. The battle ended up in court, and the conservationists won. The jetport was dead.

Or was it?

While the attention of Florida conservationists have been turned elsewhere to new and urgent campaigns, an interesting development has been taking place in the Everglades. The "un-jetport" has not exactly been returned to the bottom desk drawer in an architect's office. What many don't realize is that a two-mile concrete runway and a control tower had already been completed before work on the jetport was halted. In the original agreement of January 16, 1970, known as the "Jetport Pact," it was specified by the co-signing Dade County, federal and state officials that the existing $13-million runway and tower could be used as a training ground as long as it had no ill effects on the wildlife in the area.

This is exactly what has happened, to the tune of nearly 100,000 landings and take-offs from the unfinished airport in 1972 alone. Commercial, military and private pilots use the 34-square-mile Everglades airstrip as a training field. The bulk of the traffic consists of practice flights by Eastern and National Airlines. There is approximately one take-off or landing per minute, round the clock, weather permitting.

MIAMI INTERNATIONAL OVERCROWDED

The reason for using the Everglades facility for training flights was primarily to reduce traffic at Miami International Airport. This has been successful; take-offs and landings at Miami International dropped

off from 400,000 in 1969 to 280,000 in 1972. Most of the difference was directly attributable to the transfer of practice maneuvers to the Everglades site. The director of the Dade County Port Authority, Richard Judy, indicated that the re-distribution of air traffic lessened the risk of a crash in the populated Miami Metropolitan area. He also stated that the Port Authority had collected approximately $900,000 during the 1971-72 fiscal year from 32 airlines which have used the practice facility.

The use of the Everglades runway as a training field, then, has unquestionable advantages. The key questions which remain are: Does the present use of the airport pose a threat to the environment? and Will continued use pose such a threat?

Opinion is divided on these issues. Jim Ashlock, public relations man for Eastern Airlines, claims the effects of the present program on the environment are negligible. "Our flights only make touch-and-go landings in the Everglades and return to Miami International," he explained. "Just flying airplanes in and out has no impact on the environment. Environmentalists have been concerned with the impact of support facilities employing 10,000 or more people out there as once planned."[1]

Conservationist Lyman Rogers disagrees. He said that the pollution from one large jet taking off was equivalent to 2,000 automobiles operating eight hours a day.[2] And Bill Partington, director of the Environmental Information Center in Winter Park, said the current level of training in the Everglades "... must have a detrimental effect. The effects of the air pollutants on the watershed are subtle and they have a tendency to magnify as they go through the ecological chain," he warned. "Such things are never accurately anticipated, but one day you'll wind up with fish on your plate that has gunk from an airplane."[3]

ENVIRONMENTAL WATCHDOGS

The only way to resolve the controversy is through direct scientific observation. That is precisely what the Federal Environmental Protection Agency has set out to do. Beneath the control tower at the Everglades airport is a trailer loaded with sophisticated equipment to measure air pollution, installed by the EPA

last March. Water pollution samples have been taken periodically for the past two years. Noise pollution equipment was installed December 17, 1972.

The results so far have been inconclusive. The data from the recently-installed noise pollution equipment has not yet been analyzed. John T. Brown, coordinator of the South Florida Environmental Project for the U.S. Department of the Interior and supervisor of the pollution-monitoring program at the airstrip, pointed out that "...the sound of an airplane is not distinguishable from the bellowing of an alligator in mating season."[4] Water pollution samples have not yet discovered any negative effects on the swamplands. The only area with a positive result thus far has been air pollution; there have been high readings on occasions. The only specific pollutant to exceed federal standards has been ozone, but this is the key element in the corrosive smog which plagues Los Angeles. The EPA will continue to monitor pollution levels in the Everglades in an attempt to gather more precise evidence concerning the effects of the airplane training program on the environment. In the mean time, egrets and other wading birds have taken up residence in a mudhole right behind the pollution-control trailer, apparently undaunted by the antics of their metallic counterparts. Alligators, wild hogs and deer occasionally work up the nerve to venture across the asphalt and concrete. There has been no immediately apparent impact on the environment.

FUTURE PLANS OUTLINED

What is the future of the Everglades airstrip? The ruling against its further development appears firm, but the use of the runway as a training strip is apt to continue. The 1970 pact expired in January, 1973, but renewal was expected, as both the Federal Departments of the Interior and Transportation and Dade County officials favored renewal. "Renewal of the pact is not really contingent upon these pollution results," Brown explained. "But if there is harm to the environment, if an adverse impact can be shown, a shutdown of the training facility may be sought and the operations stopped."[5] Walter Revell, secretary of the Florida Department of Transportation, said the Everglades site probably would remain in use until runways at a new site

were in operation some time between 1977 and 1982.[4] Some airline officials indicated that the training field would be utilized even past those dates, due to ever-increasing air traffic at crowded urban areas.

One positive factor for the environment at present is the fact that much of the present air traffic at the training field is comprised of Eastern's new Lockheed L1011 jet, a wide-body liner capable of transporting 226 passengers, and National's DC 10. Both, according to airline spokesmen, have the latest emission control devices on them to minimize the danger to the environment.

On the other side of the coin, the development of such new aircraft means that many domestic airlines are contracting their older planes to foreign carriers, whose pilots train at the Everglades practice field. These aircraft, of course, do not have advanced emission controls.

The future of the Everglades airport, then, is uncertain. It is undoubtedly serving an important function to the airlines. So far this function has apparently been served WITHOUT major damage to the environment. Scientific observation will continue, to make sure this remains true. Is it possible, as some conservationists fear, that the Everglades have already suffered damage which will not be revealed until it progresses further along the ecological chain?

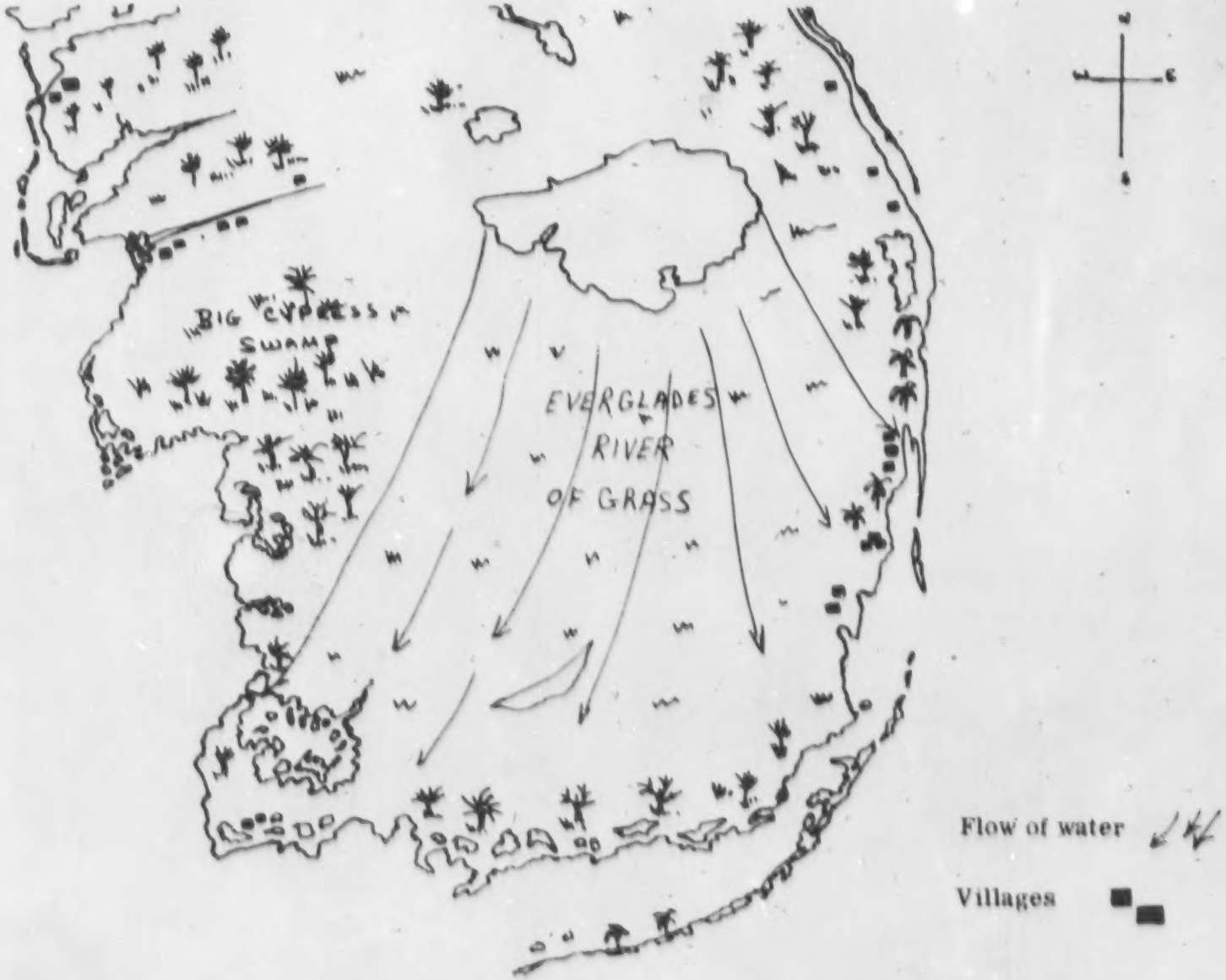
Only time will tell.

-- Tatro, Nick, "The Jetport That Isn't," TODAY Newspaper, Jan. 14, 1973, p. 1E and 6E.

Notes

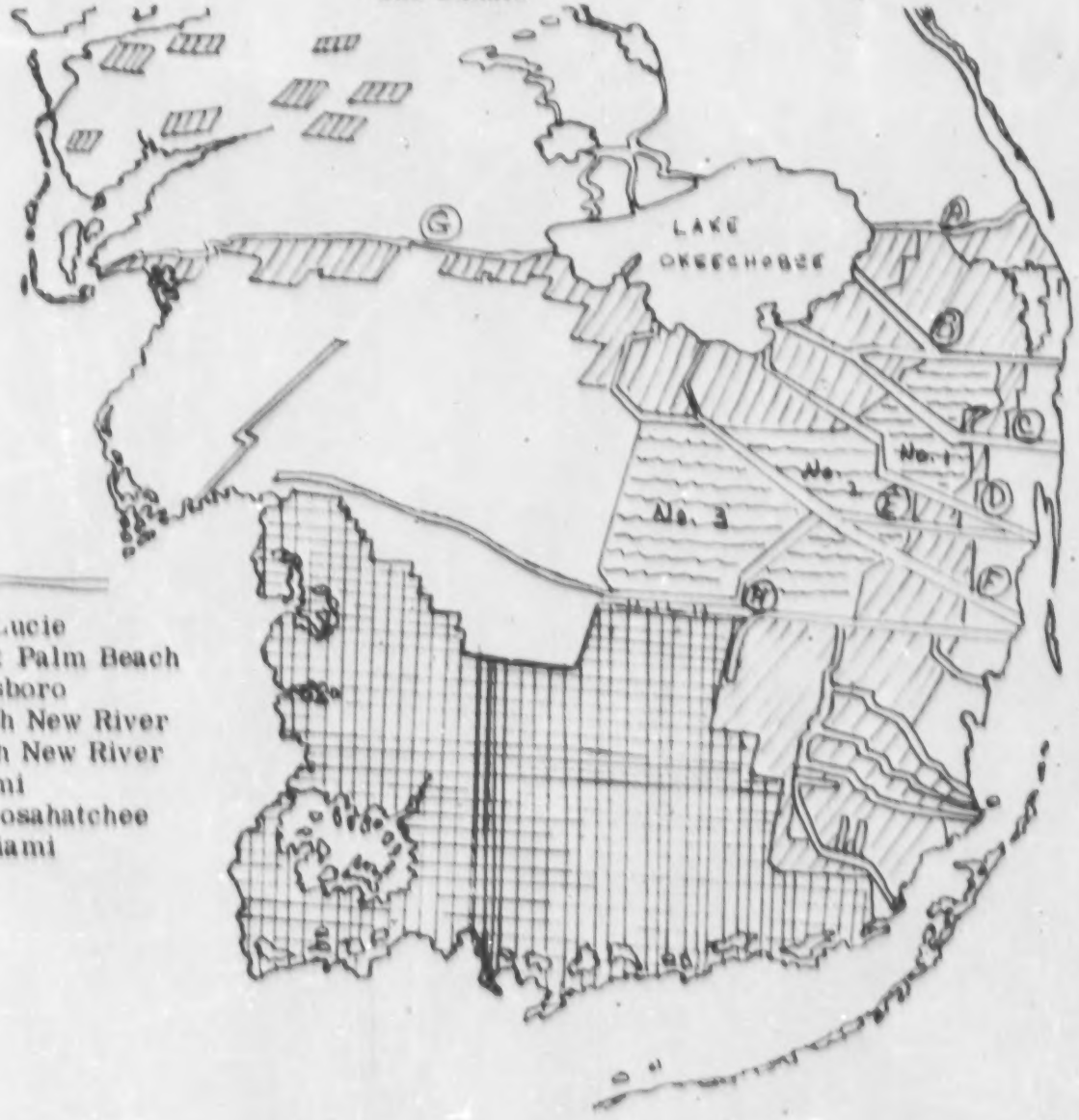
[1] p. 6E
[2] p. 6E
[3] p. 6E
[4] p. 1E
[5] p. 1E
[6] p. 1E

STUDENT COMMENT NO. 47: 1871 Map of Everglades



151

STUDENT COMMENT NO. 48: South Florida's National Park, Conservation Areas, Agricultural Zones, and Canals



Canals:

A. St. Lucie
B. West Palm Beach
C. Hillsboro
D. North New River
E. South New River
F. Miami
G. Caloosahatchee
H. Tamiami

Everglades National Park

Conservation Areas

Agricultural Zones

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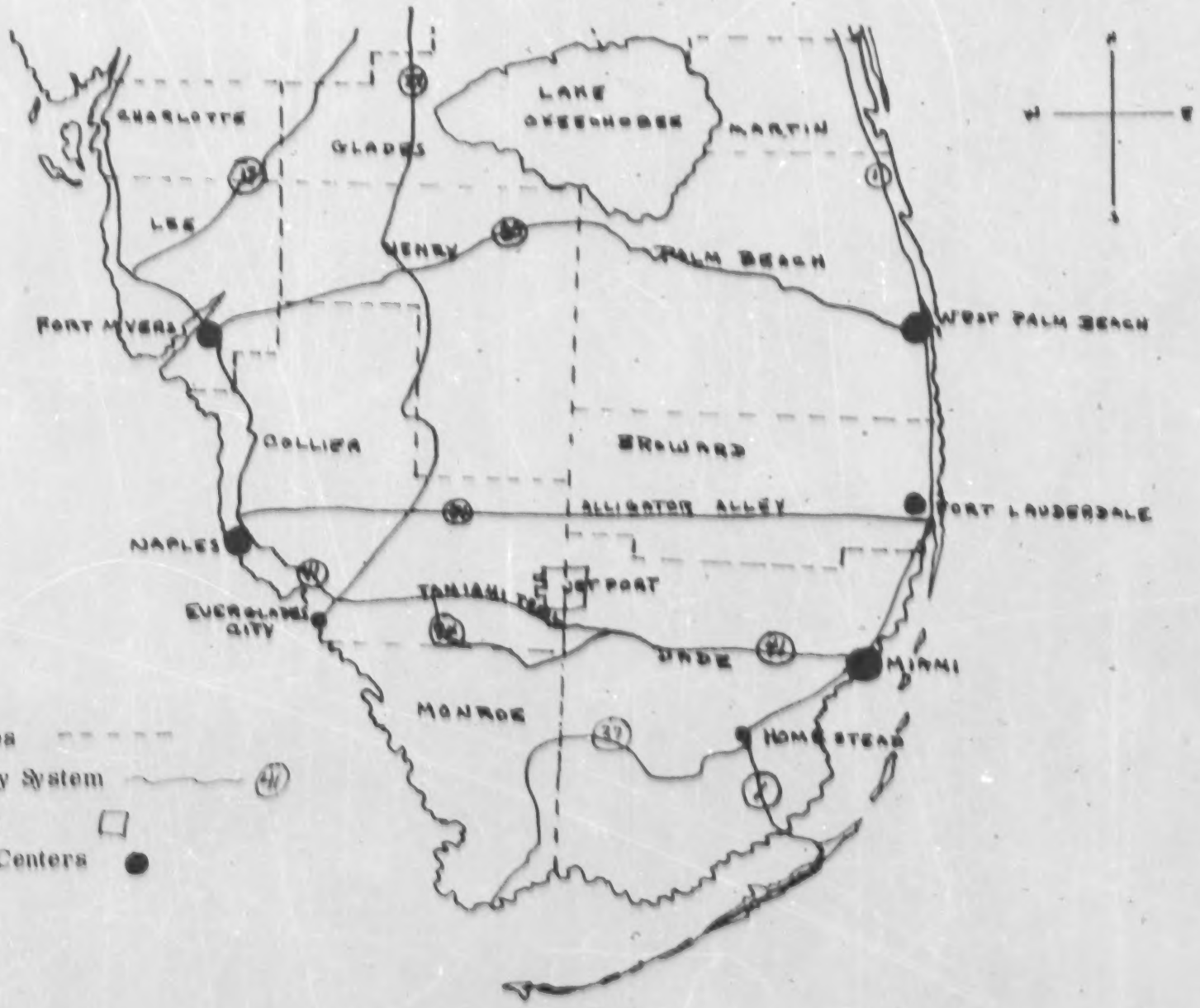
STUDENT COMMENT NO. 49: South Florida's Counties, Major Cities, Highway System and Jetport



STUDENT COMMENT NO. 50: Outline Map of South Florida

STUDENT COMMENT NO. 51: The Everglades is the Miner's Canary of the Gold Coast

For the past dozen years, a handful of natural scientists and many more citizen-conservationists have noted and publicized the growing plight of the Everglades. In true ecosystem fashion, they have often remarked that "as the Everglades goes, so goes the urbanized Gold Coast of southeast Florida," or "the Everglades is the miner's canary of the Gold Coast."

No one really has considered the whole life-system of south Florida in a substantial ecosystem fashion. I have, for example, spoken almost entirely on the wilderness or rural portion of the south Florida ecosystem, and it probably would not be too much noted if I did no more than that.

We are overdue on turning the coin around, in observing and quantifying the stresses on the urban, the people portion of the ecosystem, and in saying that "as the Gold Coast goes, so goes the Everglades."

We must now quantify and publicize a series of urban stresses - the urban equivalents of alligators, wood storks and deer. Some of them are:

water shortages
power shortages and power generation problems
water and air pollution
traffic problems, accidents and transport problems
public health - mental and physical
the overload on schools, courts, jails, hospitals, etc.
crime
job and housing availability
availability of park and recreation areas

Quantification of these items should be accomplished, where possible, on a per capita basis.

In the city ecology and economy clearly come together. Most of the cities of the Gold Coast are bankrupt. They are unable to supply the essential services their large populations require - some

examples of which I inferred above. The depressed areas, the slums and ghettos, are huge and spreading for this is where sparse funds dry up first. The entrance of federal funds to fill the financial gaps - on school lunch programs, sewage systems, police training and hosts of others - isn't just desirable, it is necessary. Even these found funds often perform a cosmetic function, like burying a fish kill, and do not rectify the basic problem.

The farther waste has to be transported to the city, the more it costs. The greater the level of treatment required for water supply or sewage wastes, the greater the cost. I suspect human density is a potent environmental factor - in city costs - in compelling exponential increases in police per capita, traffic lights per capita, hospitals and jails per capita, etc.

It is just possible, I believe, that had we taken effective steps to keep Gold Coast cities economically viable instead of the financial wretches they are, and thus to keep their people under much less stress, that the Everglades would have been spared many of its problems. It is fair to say, even now, that as the spread between per capita revenue and per capita cost widens for the cities of the Gold Coast, stresses on the Everglades will increase. Demands for federal aid will further increase. And now, the Aid to Cities Act of the Florida legislature will provide state funds to pressed cities, demands for which will increase.

I am sure that no all environmental degradations can be related so directly to urban growth, stress and bankruptcy, but that of the Everglades is linked to the fate of the Gold Coast, in true ecosystem fashion. Here ecology and economy have come together, in belated recognition of the derivation of their names from the same Greek work - oikos - home.

And none too soon, for the Glades and the people of the cities and for the public economy.

I suspect that we yet have a choice. We can learn to respect the assimilative or carrying capacities of our environmental resources - air, water, space, etc., - and to recognize exponential stress increases and cost increases associated with accommodation of large populations, or we can have continued increase in the number of bankrupt cities.

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I am sure it won't solve all of our environmental problems everywhere, but regulation of population sizes and distribution to accord with total funds available to Gold Coast cities and thus to the limits of the region's natural resources would have done a great deal to avoid the harm done to the Everglades. With Florida's great surge of population - expected to double by 2000 - we must either support its people on the least per capita cost basis, or double taxes or suffer continued bankruptcy of cities, growing despair in the cities and badly degraded environmental values in large regions of the sunshine state.

Marshall, Art, "Alligators and Cities Lessons from the Everglades," The Florida Naturalist, August, 1972, p. 100.

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TEACHER COMMENTS

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TEACHER COMMENT NO. 1 : Living/Non-Living?

One of the hardest things for a student to do is to decide what is considered biotic or abiotic. If biotic is defined as living or recently living, it must be determined what constitutes life.

Life involves ten basic processes that are integrated into a single product, that of living. If any of these functions are absent, then the object being investigated is not alive.

The ten elements of life are as follows:

1. Nutrition (food getting)
2. Locomotion or motion
3. Irritability (sensitivity)
4. Digestion
5. Absorbtion
6. Assimilation
7. Circulation
8. Secretion
9. Excretion
10. Reproduction

This is an all inclusive list of elements. Other scientists use lists of varying size but most place two or three of these basic elements into other encompassing categories.

TEACHER COMMENT NO. 2: Evaluating Small Group Work

Many teachers refuse to incorporate small group work in their classrooms because they lack a satisfactory procedure for evaluating the outcome of such efforts. For the purpose of this unit of study, we suggest the use of the following process for checking the results of groups investigating each Inquiry Question. Use only where it is practical to do so.

1. At the end of the study of each Inquiry Question, there will be an exercise in the Learning Activities column entitled Check I. Q. At this point have each individual within a small group write out what he thinks is the answer to the Inquiry Question, by filling out the upper half of the I. Q. (Inquiry Question) Check in Student Comment No. 1, Page 37.
2. Teacher collects I. Q. Check sheets and gives to a different small group for grading.
3. Class members will:
   a. Have in front of them a copy of class conclusion for the Inquiry Question arrived at during the investigations.
   b. Decide how many total grade-points should be possible for the proper response to the Inquiry Question.
4. Each small group will compare the answer sheet handed it with class conclusion and then fill out that lower half of the I. Q. Check form. Experience has shown that more honest and serious evaluations are made when students do not know who is checking whose paper. The name of the checker on the I. Q. Check form is for the teacher only.
5. Return I. Q. Checks to teacher who may reveal scores to students.

If this method of evaluation is employed, it would be essential for students to remain in the same small group until completion is made of all investigations for any one Inquiry Question.

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TEACHER COMMENT NO. 3: Life In A Marsh

PHYSICAL CHARACTERISTICS

A balanced marsh has (1) deep water areas, (2) shallow water areas or shoals, (3) heavy emergent vegetation on some of the shoreline, (4) bare areas on some of its other shores, (5) flooded grassy meadows, and (6) dry grassy meadows.

ANIMALS AND PLANTS COMMON TO EVERGLADES FRESHWATER MARSH

Animals

Marsh rabbit
Round-tailed muskrat
Otter
Manatee
Painted bunting
Common egret
Snowy egret
White pelican
Cormorants
Purple gallinule
Common gallinule
Anhinga
Little blue heron
Green heron
Great blue heron
Louisiana heron
Black-crowned night heron
Rail
Everglades kite
Limpkin
Coots (and many other varieties of transient ducks)
American bittern
Stilt
Red-shouldered hawk
Green snake
Banded snake
Everglades swamp snake
Water moccasin
Soft-shelled turtle
Yellow-bellied turtle
Alligator
American crocodile
Green tree frog
Narrow-mouth toad
Southern bullfrog
Mosquitofish (various kinds)
Mullet
Shrimp
Lubber grasshopper
Pomacea snail

Plants

Arrowhead
Sawgrass
Leather fern
Flag
Maidencane
Pickerel weed
Cattails
Hyacinths
Sedges
Mallow
Lotus
Lily

Also found are occasional Everglades panthers and various kinds of deer.

TEACHER COMMENT NO. 4: Large Group Discussion • Evaluation

The following checklist is offered as an example of a device which may be used to lend a degree of objectivity to evaluating student participation in class discussions. The teacher may involve students in the evaluative process by devising a rotation system whereby two or three students would evaluate class members during class discussion periods.

When evaluating student comments in class discussion consider the following items:

a. Quantity of student contribution.

b. Content of student's remarks as these indicate knowledge of topic, critical and/or innovative thinking by student

c. Relevance of student's remarks to subject under consideration.

d. Clarity of expression and presentation by student.

Based on the four considerations above, points should be awarded on a five point rating scale:

5 points-excellent

4 points-above average

3 points-average

2 points-below average

1 point-poor

Separate points should be given for each comment made by a student and recorded in the appropriate column in the sample Evaluation Sheet for Large Group Discussion below:

Evaluation Sheet for Large Group Discussion

NAME	POINTS	TOTAL
1. Sam Sunshine	4, 3, 4, 2	13
2. Mary Mushroom	1, 5, 2	8
3. Fred Frog	3, 3, 2, 1	9

TEACHER COMMENT NO. 5: Everglades Survival Game

INTRODUCTION

This game will provide a framework within which the student will investigate the environmental changes which have occurred in the Florida Everglades. It will also provide activities which are designed to make the student aware of the consequences of other types of change which might occur in the Everglades. Because of the various roles they will be playing and the activities they will be engaged in, the student will gain a new awareness of all of the ramifications of environmental change. The student will investigate the history of the Everglades and he will discover the natural and man-made changes which have occurred in this area. The student will become involved in making value judgements in relation to environmental change and he will gain a new awareness of the complexities and conflicts surrounding many environmental changes. The game will end with the students arriving at answers for the six inquiry questions found on page 141.

OVERVIEW

Role Playing

All students will assume an identity by drawing from a box or hat. A list of permanent identities needed for purposes of the pressure cards is given on page 143, however, additional identities may be assigned for specific activities as called for in the directions for that activity. Class leadership will be provided by a student playing the role of the Governor of the State of Florida, a Lt. Governor, and a Secretary for the Governor. The duties of the class leadership are found on page 142.

Evaluation

Students will earn ESP (Everglades Survival Points) for all activities they participate in. Points

may be awarded for research, oral presentations, role playing activities, tests, or any other constructive activities associated with developing a better understanding of the issues surrounding the survival of the Everglades. At times the students may lose ESP as the result of pressure cards which have an adverse effect on them or an adverse effect upon the Everglades. All students will maintain a record of their ESP on a balance sheet (see sample on page 144). Grades for this game will largely depend upon the number of ESP earned during the activities. At the conclusion of the study of the Everglades, teachers up all points, arrive at an average for the class, and then assign letter grades according to their own philosophy of grading.

Pressure Cards

Sample pressure cards are found on pages 146-148. The teacher may wish to construct other pressure cards as the study progresses. Pressure cards should be cut out and placed in a box and drawn from time to time to create controversy, to illustrate the consequences of some environmental changes, and to motivate students to seek ways to deal with problems presented by these cards. Pressure cards may serve as springboards for simulated hearings, legislative proposals, small group problem solving sessions, independent study projects, etc. Only the interest and imagination of the students and the teacher can limit the full implications for activities growing from these cards. The teacher should offer generous amounts of ESP to students who pursue the problems raised in these cards and come up with solutions. The teacher may elect to have a card drawn each day, every other day, or however they wish to use them. These cards can be very successful in motivating students and in creating suspense and excitement in the classroom.

Resource Collection

Encourage students to collect news articles, books, pamphlets and other items pertaining to their

specific area of environmental concern. Reward students for appropriate donation by giving them ESPs. Fifteen to 25 points per item might be a reasonable guide.

Advice Forms

A sample of the "Advice Form" is found on page 145. Students may use this form to write advice to the Governor throughout the course of the game. They should write advice about environmental issues and they should complete the form. The Governor will evaluate the Advice forms turned into him and award from 0 to 30 ESPs for each form. Encourage students to write advice forms to the Governor in which they advise him on the course of action to take in regard to the pressure cards which have been drawn. Students might also be made aware that this is an excellent way to gain back points lost due to pressure cards.

CONCLUSION

After the students have completed all of the activities in the Everglades unit, the concluding activity will be to arrive at conclusions for the six inquiry questions below:

Inquiry Questions

V. What biotic and abiotic features in the ecosystem have changed and are undergoing change?

VI. What are the natural factors causing change in the ecosystem and how have they been brought about?

VII. What are the man-made factors causing change in the ecosystem and how have they been brought about?

VIII. What are the results of the changes?

A. Beneficial?

B. Detrimental?

IX. What, if any, new changes are needed in the ecosystem?

X. How might these needed changes to the ecosystem be brought about?

CLASS OFFICIALS FOR EVERGLADES SURVIVAL GAME

It would be most helpful to have a class staff of officers to help implement and react to the various activities in this study of the Everglades. Have the students elect a Governor and a Lt. Governor to be the chief officers of the class during this study. The Governor may appoint a Secretary to assist him and the instructor. All students may write advice forms to the Governor about any of the issues which arise during the simulation. If the student advises the Governor to take some action which he has no power to take, he should be prepared to notify the student of the proper governmental agency or the proper course of action to take in implementing the advice given. The Governor and his staff will evaluate all advice forms and award the student who wrote the advice form from 0 to 30 ESPs for their work. (See a copy of the "Advice Form" on page 145.)

SOME OF THE MAJOR DUTIES OF THE GOVERNOR AND HIS STAFF

1. Work with the teacher in coordinating activities, preparing materials, initiating new activities, and presiding over large group sessions.
2. Read, evaluate, and return all Advice Forms.
3. Research all courses of action open to citizens in seeking redress for environmental abuses and refer students to the proper course of action to take to help them in solving environmental problems.
4. The Secretary will check the roll daily, maintain a record of student contributions in class discussions, and assist the Governor in fulfilling his responsibilities.
5. The Governor will serve as the chairman of the "Review Team" in the Jetport Controversy activity.

PERMANENT ROLES FOR EVERGLADES SIMULATION

(Pressure Cards will pertain most to these roles)

1. Citizen of Miami
2. Farmer South of Lake Okeechobee
3. Oil Company President
4. Owner of a Major Tourist Agency in Miami
5. Director of Bureau of Indian Affairs
6. Director of the Water Control Division of Dade County, Florida
7. Head of Florida Highway Department
8. State Secretary of Agriculture
9. President of a Major Land Developing Company
10. Director of Miami Airport
11. Everglades Park Ranger
12. Secretary of the Interior
13. Professional Fisherman off Southern Coast of Florida
14. Camper
15. Citizen of Everglades City
16. Governor of Florida
17. Duck Hunter in New York
18. Poacher

ESP BALANCE SHEET

Name

Permanent Role

Activity Roles:

Date	Activity or Item	-	+	Balance

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ADVICE FORM

Score _____

Student: _____ Period _____ Governor: _____

Source of information: _____

Author Title Date Page

_____ _____

Magazine, Newspaper, TV, Authoritative Source, etc. Role

Information (facts): _____

_____

_____

_____

_____

_____

_____

_____

_____

Because of the above information, I advise you to take the following action: _____

_____

_____

_____

_____

PRESSURE CARDS

Pressure cards may be introduced by the teacher whenever they would be of the greatest effect in motivating students or the teacher may have students periodically draw cards.

PRESSURE CARD #1:

A series of deep canals have been built to drain off water and prevent Lake Okeechobee from overflowing and flooding the area south of the lake. Dikes have also been built as that water will not cover the land and it can be used as farm land. As a result of the construction of the canals and dikes, the rich black soil has dried up in the hot sun and much of it has blown away in clouds of dust, some of the soil has been washed out to sea in the poorly designed drainage canals, and fires have damaged other areas. The peat continues to shrink and it is estimated that in a few more decades, in places, it will be gone forever.

Everyone Loses 10 ESP
Farmers South of Lake Okeechobee Lose 20 ESP

PRESSURE CARD #2:

The State of Florida has granted the right to a mining company to mine limerock in the big lake, as a result the drinking water for the citizens of Miami will be contaminated. *

All Citizens of Miami Lose 20 ESP

*This event was almost a reality but was stopped at the last minute in the courts. See how your students choose to handle it.

PRESSURE CARD #3:

The Bureau of Indian Affairs has approved extensive leases for oil drilling in the Everglades immediately north of the Park. A total of over a hundred-thousand acres is involved, on two Seminole reservations. Oil has already been brought to the surface within two miles of a main drainage canal that feeds directly into the big reservoir area which sprawls into the heart of the South Florida fresh water system. Conservationists warn of great danger of oil spills and contamination of the entire fresh water system.

Everyone Loses 10 ESP

PRESSURE CARD #4:

The Director of the Water Control Division of Dade County, Florida, has announced that "The national park is simply going to have to give way to the water demands of people, probably starting around 1985. There won't be enough water for both, and the people come first."

Everyone Loses 10 ESP

PRESSURE CARD #5:

The careless use of pesticides such as DDT, DDD, DDE, BHC and BCH is causing serious poisoning of humans, birds, and animals and destroying the microscopic plants that are responsible for maintaining more than ninety percent of the oxygen we need to remain alive.

Everyone Loses 10 ESP

PRESSURE CARD #6:

It has just been predicted by experts that the continued drainage of the Everglades will result in colder Florida winters, a condition which will in time discourage tourists from coming to Florida.

Tourist Agency Owner Loses 30 ESP

PRESSURE CARD #7:

A major land developer has bought up most of the Big Cypress Swamp area and plans to subdivide and drain the swamp and build a major new housing development in the area.

Everyone Loses 20 ESP

PRESSURE CARD #8:

Florida superhighway planners have announced that they plan to route a new Interstate 75 from the Florida Gulf coast through the Everglades to the eastern side of the state.

Everyone Loses 10 ESP

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PRESSURE CARD #9:

(This card might be used as an introduction to the Jetport Controversy Activities.)

The Dade County (Miami) Port Authority has made plans to build a super airport some 45 miles west of Miami, in the very heart of the glades. This airport is to relieve much of the air traffic pressure on Miami's badly overcrowded air terminal.

Everyone Loses 10 ESP

PRESSURE CARD #10:

Poachers set fire to the sawgrass in the glades in order to uncover alligator holes, destroying many other animals and many acres of vegetation. The poachers skinned and left the remains of several alligators near the holes.

Everyone Loses 10 ESP

PRESSURE CARD #11:

Of all the factors that determine the quality of our environment, the most fundamental is the use we make of our land. Most of the environmental problems we face today stem from the misuse of the land. The way each acre of land is used is of concern to the Community and ultimately to the nation and to the world.

Everyone Loses 20 ESP

PRESSURE CARD #12:

October 6, 1971, an immature Bald Eagle, feeding on carrion on the Sunshine Parkway was struck a glancing blow by a passing vehicle. In a way this accident was the result of many eagles changing their feeding habits due to heavier populations around the lakes where they fish. Animal kills are more frequent and easier to get on the expressways. Consequently the number of eagles being injured and killed is on the rise. Our American Symbol is vanishing.

All Patriots Lose 20 ESP

TEACHER COMMENT NO. 6: Active Involvement From Learning Centers Concept

I. DEFINITION OF LEARNING CENTERS

A harmonious grouping of materials and equipment so arranged as to emphasize some particular idea, principle, or theme growing out of children's various learning activities. (Dictionary of Education)

II. RATIONALE FOR LEARNING CENTERS

A. Increased personalization
B. Developing self-initiating learners
C. Eliminates need for uniform seat work
D. Adapts well to team teaching
E. Ease of implementation
F. Give students practice in decision and self-discipline
G. More teacher freedom
H. Better discipline

III. CHARACTERISTICS OF A LEARNING CENTER

A. Self-instructional
B. Cover several ability levels
C. Seek specific objectives
D. Method of Recording
E. Method of Assessment

IV. KINDS OF CENTERS

A. Subject
   1. Language Arts
      a. Reading
      b. Spelling
      c. Handwriting
      d. English
   2. Math
   3. Science
   4. Social Studies
   5. Religion

B. Interdisciplinary
   1. Music and Social Studies
   2. Art and Science
   3. Language, Math, Science, Music, Art and Religion
   4. Environmental Studies

C. Process or Skill
   1. Questioning
   2. Classifying
   3. Communicating
   4. Listening
   5. Deciding
   6. Awareness
   7. Problem Solving

8. Creating
9. Predicting
10. Valuing
11. Analyzing
12. Synthesizing

V. BUILDING A CENTER

A. Decide how it will be used
B. Choose a topic, goal, and spell out a few objectives
C. Think up learning activities for each objective
D. Gather and make necessary materials
E. Write out clear directions
F. Devise a scheme for recording and evaluation
G. Try it out and make adjustments and repairs

VI. USES OF THE LEARNING CENTER

A. Enrichment
B. Reinforcement
C. Recreation
D. Remediation
E. Motivation
F. Skills of continued learning
G. Academic – Subject Matter

VII. DUTIES FOR THE CHAIRMAN OF THE LEARNING CENTER

A. Check Center before and after an experience, to see if materials are in order.

B. Read materials at Center and locate more materials if needed.

C. Act as a recorder or a referee.

D. Show films at Center or to entire group.

TEACHER COMMENT NO. 7: Southward Ho!

FRONTIER DAYS

These words generally conjure up images of stout-hearted, leather-clad cowpokes fighting off blood-thirsty Indians with one hand and black-moustached cattle rustlers with the other; fanatical prospectors with grizzled beards, knapsacks full of dried beans and salt pork, and a golden gleam in their eyes; and swash-buckling Mississippi riverboatmen weaving a perilous path among river shoals, saloon brawls and traps laid by smartly-clad hustling "dudes" from back east.

But the frontier of the Old West was not the only frontier in American history. Another frontier steeped in a tradition of similar color and excitement is to be found right in southern Florida -- in the Everglades and near Lake Okeechobee. Instead of mountains and prairies, it was water and sawgrass. Instead of wagon trains and buffaloes, it was steamboats and alligators. Instead of plows and cattle, it was dredges and catfish. There were Indians, however, and an ample helping of outlaws, eastern city dudes and squatters. The men who first settled in the Everglades faced a wilderness every bit as challenging as the frontier out west.

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UNTAMED WILDERNESS

Although the area south of Lake Okeechobee is today a large complex of farms and ranches with modern urban centers, it wasn't too long ago that the Everglades were virtually untouched, let alone harnessed, by man. The first event of significance in the history of the Lake Okeechobee area occurred in 1837, when Col. Taylor fought with the Seminole Indians. After that there were no white settlers in the area for about 50 years, with the exception of an occasional hunter or a deserter from the Confederate Army. In the 1880's, Hamilton Disston brought in dredges to carve a water pathway from his settlement of Kissimmee to Lake Okeechobee, and from the lake to the Gulf of Mexico. Development still didn't take

place on a large-scale basis, however. Men fished for catfish in the area, and stories about the rich potential of the land under the Everglades began to drift toward Tallahassee. Seeking a new source of revenue (the state had already given away most of the public land north of the Everglades to the railroads), Governor William S. Jennings in 1901 looked upon the Everglades with new interest. The territory had been granted to Florida by the federal government in 1850 with the provision that it would be drained, but no one had been interested. Now the governor was interested. Jennings' successor, Governor Broward, got the drainage project underway by selling large acreages of the wet and undeveloped sawgrass prairie to sales organizations which, in turn, launched a nation-wide publicity campaign to sell the land in 10 and 20-acre parcels. However, the plan backfired. The task of drainage was too great and funds were too limited. Settlers' dreams were burst on the sharp spikes of sawgrass, drowned by floods during the rainy season, bogged down in the fertile but nearly unmanageable muck, and even frozen during winter frosts (a hazard the national sales promoters had neglected to mention in their panoramas of a tropical paradise). The sawgrass settlers were unable to make a go of it. Some retreated to higher land on the shore of Lake Okeechobee, where they were able to scratch out a meager existence, still beset with numerous hardships. Others left altogether.

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DOWN THE DRAIN!

More canals were dug, to control the natural overflow from Lake Okeechobee (which flowed southward into the Everglades) and to drain the sawgrass regions. During seven years of limited rainfall, the drainage was successful. In fact, the Upper Everglades became so dry that fires raged out of control on the high ridge of land south of Lake Okeechobee. Vegetables and sugar cane were planted. But the canals had not been the only cause in controlling the water system of the area. Nature's "cooperation" (in the form of limited rainfall) had been essential. When the heavy rains returned, farmers were again flooded out.

To protect residents in communities along the south shore of the lake, a hurricane dike was constructed. The hurricanes of 1924 and 1928 proved more than a match for the flimsy structure, however. Lake Okeechobee surged outward over its southern rim into the sawgrass prairie, and thousands perished. (See Student Comment 25, "Nature Strikes Back," p. 80). Still the frontier spirit prevailed, just as it did against tornadoes and dust storms out west. The government responded to the disasters by erecting the Hoover Dike, a much more formidable levee which afforded real protection. As a result, settlement soon boomed along the lake shore. A whole new wave of pioneers moved into the region in the 1930's and 1940's. They built dikes and installed pumps at their own expense to drain stretches of the sawgrass swamp in order to tap the agricultural potential of the rich black peat. They planted hundreds of acres of vegetables and converted even larger tracts of sawgrass into pastureland. But still the spectre of watery disaster lurked in the wings. Sure enough, in flood times the entire northern region of the Everglades was submerged with 3-4 feet of water. When the embattled farmers tried to pump the floodwaters off their crops, they had no place to put it! And during droughts there was no source of water to be found. Nevertheless, farmers managed to reap some excellent harvests from the rich peat, but it was a risky venture at best.

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HERE COMES THE CAVALRY!

In the Wild West, the settlers were often saved from Indians by the welcome sight of the cavalry charging over the hill in a cloud of dust and clamor of trumpets. For the beleaguered Everglades farmer, the "cavalry" was the Central and South Florida Flood Control District and its collaborator, the Army Corps of Engineers. These organizations have completed a large-scale project which no individual farmer could ever attempt -- deepening canals, building miles of big dikes and installing huge pumps. Even in its incomplete stages, the new flood control network greatly lessened the risk of losing crops to rampant floodwaters. The growing system of canals and pumps also held the promise of a controlled, stable water

supply even during periods of drought. It seems as if the 20th century is finally converting the Everglades settlers from pioneers to modern, scientific farmers . . . but the road has been long and arduous.

Will, Lawrence E., A Cracker History of Okeechobee, The Great Outdoors Association Craftsmen, 1964, Chapter One, "A Heck of a Frontier," pp. 1-4.

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TEACHER COMMENT NO. Water Control Data Chart

Year[1]	Rainfall[2] (Yearly total in inches	Water Discharge[3] (Yearly total in acre feet)	Gauge (water) Height[4] (Readings in feet)	
			Lowest	Highest
1963	62.41	0	2.25	6.30
1967	53.52	181,400	3.98	7.10

* 1 acre-foot = 43,560 cubic feet

[1]Data for columns 1 and 2 given in calendar year while other columns given in water year.

[2]Readings taken at 40 Mile Bend Rain-gauge Station.

[3]Readings taken at Flood Control Water Gates.

[4]Readings taken at Everglades P-33 water level gauge.

TEACHER COMMENT NO. 9: Pros And Cons Of The Everglades Jetport

A strong case can be made FOR the installation of a new jetport in South Florida. In 1968, Miami International Airport was the 11th busiest airport in the United States, handling a total of 445,000 operations (take-offs and landings) in the year. Completely encircled by urban development, the airport could not be expanded. Records indicated that some 25% of the operations at Miami International were not commercial flights, but training maneuvers for pilots and crews. Therefore, when the Nixon administration decided to bar the further development of the partially-constructed Everglades jetport, it was with the specific provision that the completed runway and tower be used for at least three years as a training field to take some pressure off the overcrowded facilities at Miami International. Although this training procedure does not appear to have inflicted serious damage on the environment at the present time (See Student Comment No. 46, "Meanwhile, Back in the Glades . . .", p. 123), the solution is at best short-term, because constantly-growing air traffic is expected to overload Miami International again within the next few years. This process may be accelerated by the conducting of high-intensity "come-to-the-sun" advertising campaigns in northern states. Someday the difficult decisions concerning the Everglades jetport may have to be made all over again. In that event, it will be necessary to re-examine the possible environmental consequences of developing the jetport. Five major problems are anticipated:

1. NOISE POLLUTION. Although the removal of training flights to the Everglades reduced the levels of noise pollution over a large metropolitan area, it brought the problem into a new area. The "jet corridor" to the Everglades facility is only five miles from the reservation of the Miccosukee Indians, who had long been accustomed to the peace and quiet of the Everglades. Furthermore, jet patterns extend over Everglades National Park, causing an unwelcome intrusion upon the wilderness experience of park visitors. The concept of wilderness experience was deliberately included in the act which established the park, and

it is now being eroded. Completion of the Everglades jetport would subject the park to a constant bombardment of noise.

2. AIR POLLUTION. Air pollution from jet operations is different from the pollution caused by emissions from ground-level vehicles. Car exhausts are rapidly diluted by mixing with uncontaminated air above, but pollutants from incoming and outgoing aircraft settle slowly over a long corridor, generally about two miles across and 20 to 40 miles in length. A jetport handling a million operations per year (about twice that of Miami International at capacity) produces nitrogen oxides in an estimated concentration of 20-millionths of a gram per cubic meter of air. Even without adding the pollutants from surface vehicles and factories, this level is approximately twice the level of nitrogen oxides measured in Washington, D.C. (from all sources). Additional airport operations may therefore endanger the usually high quality of air enjoyed by residents (and visitors) of southern Florida.

3. HEALTH HAZARDS FROM INSECTS. Placing an international airport near a large swamp poses the danger of spreading disease. If a swamp insect were to bite a passenger who was ill with a disease for which the insect was a carrier, it could transmit the disease to the next person it contacted. A serious epidemic could conceivably result.

4. PESTICIDES. The solution to #3 creates a new hazard to the environment. World Health Organization standards require daily sprayings of international jetports and adjacent areas with DDT. DDT is a persistent pesticide; after serving its original purpose it remains potent to contaminate the environment for years. The amount of DDT required to combat insects near the Everglades would almost certainly disrupt the ecology of the swamp. DDT from agricultural run-off has already accumulated to a dangerous degree in some species. (See Student Comment No. 28, "The Problem of Water Pollution in the Everglades," p. 92). Even if the standards were changed to allow the use of biodegradable pesticides, the delicate ecology of the Everglades would be threatened.

5. DEVELOPMENT OF SOUTH FLORIDA. The above four problems are direct threats to the environment which might result from the construction of a jetport in or near the Everglades. Possibly the greatest danger of all, however, would be an indirect consequence of building such a facility. A new jetport would undoubtedly stimulate further development of the region -- development which would, in turn, tax the water supply of South Florida, release more pollution into the environment and increase in general the threat to the ecology of the entire region.

Harte, John, and Socolow, Robert H., Patient Earth, Holt, Rinehart, and Winston, Inc., 1971, pp. 193-195.

TEACHER COMMENT NO. 10: Evaluation Form for Visuals

Four areas for the evaluation of visuals are suggested. Each area should be rated by the following scale: 5 points-excellent; 4 points-above average; 3 points-average; 2 points-below average; 1 point-poor. Note: part 4, Clarity, has four sub-areas which combine to make the total value for part 4.

Student's Name _____ Title or Topic _____

POINTS AREA OF EVALUATION

1. APPROPRIATENESS
If the student has had an opportunity to select either the topic or method of his presentation, _____ is the choice of either or both appropriate to the assignment?

2. ACCURACY
_____ Are the facts used in the presentation accurate? If not, where is the inaccuracy?

3. COMPLETENESS
Does the presentation represent a complete statement or coverage of the subject (is there material or facts omitted which makes the presentation misleading)? If not, where is the _____ presentation lacking?

4. CLARITY
Is the presentation clear to the viewer?
_____ a. Is the viewer readily able to determine the point or message contained in the presentation?
_____ b. Is the presentation free from unnecessary distractions? (pictures, drawings, etc.) which do not contribute to the purpose?
_____ c. Are the colors and sizes of lines, bars, and/or pictures suitable?
_____ _____ d. In the case of a collage or drawing, is the focal point clearly determined?

COMMENTS: _____

(Total Points)

TEACHER COMMENT NO. 11: Evaluation Form For Oral Report
(To be filled in by students and/or teacher)

Subject of Report _____ Student reporting _____

I. Knowledge of subject matter and/or what way questions were answered.

_____a. Excellent (5 points) _____b. Good (4 points) _____c. Fair (3 points)
_____d. Poor (1 point)
Points Earned _____

II. Presentation of material by using audio/visual aids. Evaluate each aid used from 0--5 points.

_____a. Charts _____b. Maps _____c. Graphs
_____d. Guest Speaker _____e. Slides _____f. Films
_____g. Filmstrips _____h. Table Display _____i. Study Guides
_____j. Puzzles/Games _____k. Skits _____l. Other
Points Earned _____

III. Equipment used in presentation. Evaluate each aid used from 0--5 points.

_____a. Opaque Projector _____b. Filmstrip Projector _____c. Overhead Projector
_____d. Film Projector _____e. Globe _____f. Chalkboard
Points Earned _____

IV. Speaker's attitude towards listeners, tone, and quality of voice should be considered. Evaluate as #1.

_____a. Excellent _____b. Good _____c. Fair
_____d. Poor
Points Earned _____

V. Evaluation of the participation of the members of the groups. (Use where applicable)

_____a. Excellent _____b. Good _____c. Fair
_____d. Poor
Points Earned _____
Total Points _____

The Freshwater Marsh as an Ecosystem
Description of Slides

SLIDE NUMBER	DESCRIPTION
1.	Open marsh with stretches of saw grass; Brazilian pepper tree.
2.	Sawgrass; cabbage palms.
3.	
4. *	Fields of saw grass; hammock of hardwood trees.
5. **	Lilly pads in slow moving water; saw grass in background.
6. *	Salt-marsh cordgrass grows where maximum exposure to tidal flooding; salt-meadow cordgrass grows in a drier setting.
7. **	Mud in tide floats of slow moving water; reflection of trees at left.
8.	Water hyacinths, a free floating aquatic herb.
9.	Water fowl, common name Coot; saw grass.
10. **	Common name Limpkin, diet is freshwater snail.
11.	Common name is Egret or Snowy egret.
12. *	Heron eating gar fish.
13. **	Bald eagle.
14. *	Water moccasin or cottonmouth.
15. **	Alligator and turtle.
16. *	Frog.
17. **	Florida Panther
18. *	Red fox killing Mallard.
19. **	Deer.
20.	Golden silk spider.

* Slides 4, 6, 12, 14, 16, and 18 from Our Living World of Nature, The North American Wetlands, The Life of the Marsh, William A. Niering, McGraw-Hill Book Company.

** Slides 5, 7, 10, 13, 15, 17, and 19 from Everglades, Patricia Caulfield, a Sierra Club/Ballentine Book.